REPORT ON THE ACCEPTABILITY TESTING OF FISH PROTEIN CONCENTRATE-TYPE B AND ROLLER-DRIED FISH IN THAILAND

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BULAN PHITHAKPOL
SUKONCHEUN SRINGAM
NOI SARIKAPUTI
THEODORE PANAYOTOU

FOOD AND AGRICULTURAL ORGANIZATION OF THE UNITED NATIONS

and

INSTITUTE OF FOOD RESEARCH AND PRODUCT DEVELOPMENT
KASETSART UNIVERSITY, BANGKOK

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Correction

Preface	line 7	Sakikaputi	--->	Sarikaputi
Acknowlegement	line 5	has also	--->	was also
Page 78	footnote	-	--->	1. One package makes 6 dishes
Page 86	footnote 3	expenditure on food in expenditure on food	--->	expenditure on fish in expenditure on food
Page 89	footnote 3	expenditure on food in expenditure on food	-->	expenditure on fish in expenditure on food
Page 114	Preference columm part F	Tast	--->	Taste
	Picture 1	(right)	--->	(top)
		(left)	--->	(bottom)
	Picture 2	(right)	--->	(left)
		(left)	--->	(right)
	Picture 4	(left)	--->	(right)
		(right)	--->	(left)
	Picture 7	(left)	--->	(top)
		(right)	--->	(bottom)

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Food and Agricultural Organization of the United Nations
Institute of Food Research and Product Development
Kasetsart University, Bangkok

May 1981

PREFACE

The authors share responsibility for the project. Ms. Bulan Phithakpol of IFRPD, as team leader, directed all the phases of the project and made critical contributions during the design phase. Dr. Sukoncheun Sringam of IFRPD supervised the preparation and modifications of the recipes, and organized and conducted all pre-tests and final tests. She also supervised and took part in the tabulation of the results. Ms. Noi Sakikaputi of IFRPD prepared and modified the recipes and cooked all the meals used for the testing. Dr. Theodore Panayotou,* as consultant, participated in the design of the project, prepared the questionnaires and analytical framework, did the computer processing of the results, carried out the analysis, and prepared this report.

* At the time of the study Dr. Panayotou was a Rockefeller-Foundation Visiting Professor of Resource Economics at the Faculty of Economics and Business Administration, Kasetsart University. He is currently with the Agricultural Development Council as a Food Policy Specialist attached to the same Faculty.

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CHAPTER 1

INTRODUCTION

In Thailand, fish is a staple food second only to rice. Over fifty percent of the animal protein consumed is derived from fish. There is an old Thai saying expressing content for "in the water there is fish and in the fields there is rice". In the past, not only fish prices were relatively low, but, more importantly, fish was widely distributed in inland waters and rice fields and hence directly obtainable by the consumer without the need for cash income.

More recently, however, population growth, construction of roads and irrigation dams and the use of agricultural chemicals have caused a marked decline in the availability and distribution of inland fish resources. Concurrently, overfishing of marine resources and declaration of 200-mile exclusive economic zones by neighboring countries coupled with rising fish exports have slowed down the growth of domestic fish supplies from the sea resulting in rapidly rising fish prices. As a result, low-income groups are becoming increasingly unable to obtain sufficient fish to cover their protein needs.

Unfortunately, neither acuaculture nor livestock have yet managed to compensate for the protein gap created by the recent decline in inland and marine fisheries. A potential solution, however, may still be provided by the marine trawl fishery which has been landing increasing quantities of small demersal and pelagic fish, most of which is classified as trashfish and used for fishmeal. While every effort should be made to manage the fishery resources so that the capture of immature fish be minimized, there is still considerable scope for converting properly-handled trashfish into fish products for human consumption.

Two such new fish products, known as Fish Protein Concentrate (FPC) - Type B and Roller Dried Fish (RDF) have been produced and consumed in Europe for several years. Moreover, FPC has been tested and

introduced by FAO into several countries with considerable success.*
Thailand, with over a million tons of trashfish landed every year and a widening protein gap, is an obvious site for testing the acceptability of the two new fish products especially among the low-income socio-economic groups. If acceptable, either or both of these products can be produced and marketed locally, making a dual contribution in the form of improved trashfish utilization and alleviation of protein deficiencies.

In this context, the Institute of Food Research and Product Development (IFRPD) of Kasetsart University, Thailand, with the support of the Food and Agriculture Organization (FAO) of the United Nations, undertook the task of incorporating Roller-Dried Fish and Fish Protein Concentrate into traditional Thai dishes and conducting acceptability tests for the new products. FAO provided the necessary quantities of RDF and FPC manufactured in Denmark and Norway respectively. The Institute has also produced a small quantity of Roller-Dried Fish from local sources. Production and marketing of RDF is planned in a second phase if the results of the first phase show the two products to be acceptable.

The objective of the present study is to report and interpret the results of the acceptability tests of Phase I and make recommendations regarding Phase II. In order to put the findings in perspective the reporting of the results is preceded by background information on the terms of reference, on the preparation of recipes and questionnaires and on the selection of project sites and samples. A brief description of the socio-demographic profile and socio-economic conditions of the sampled population is also provided. Alternative indexes of the absolute and relative acceptability of the new fish products vis-a-vis each other and vis-a-vis traditional fish products are calculated and interpreted in the sequel. Moreover, the price responsiveness of the consumers and the relationship between their background and their preferences are investigated. The study ends with summary and recommendations.

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* See FAO, Report on the Acceptability Testing of FPC Type B, FI/TF/INT 120 (NOR) - Phases I and II, Rome 1976 and 1978.

1.1 Terms of Reference

The project was carried out based on the following terms of reference agreed between the Food and Agriculture Organization (FAO) of the United Nations and the Institute of Food Research and Product Development (IFRPD) of Kasetsart University, Thailand:

(i) to conduct an experimental programme of incorporation of Fish Protein Concentrate-Type B (FPC) and Roller Dried Fish (RDF) in formulated food suitable to Thai tastes; that is, to develop comparable recipes based on traditional Thai food habits using FPC and RDF as the fish ingredients;

(ii) to test the acceptability of these recipes among low-income socio-economic groups and determine the relative level of acceptability of the new fish products vis-a-vis both their traditional counterparts and each other;

(iii) to determine the sensitivity of the acceptability levels to the relative costs of the preparations and identify the price levels at which the consumers are willing to buy the new products.

1.2 Preparation of Recipes

Among the hundreds of Thai food preparations that use fish as a source of protein twelve were selected based on the following criteria:

(1) popularity;

(2) use of fish in powder or ground form;[1]

(3) relatively inexpensive to be consumed by lower income groups;

(4) have properties with respect to smell, consistency, taste and appearance which will be advantageous to the new products (FPC and RDF).

From the twelve traditional fish dishes two separate sets were drawn, one for FPC and one for RDF. The dishes in each set were ranked by the project team according to popularity and suitability for the particular new product. The objective was to put each product to its best possible use. Some of these recipes were eliminated on *a priori* criteria, while others were prepared a number of times and pretested before their suitability could be determined. Finally, five traditional preparations

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1 This particular property was not true to the same degree of all twelve preparations. It was, later, used as a criterion to reduce the number of preparations further.

were selected for RDF and five for FPC. Each dish was prepared with both the traditional fish ingredient (usually fresh fish) and with the new fish product and pretested with ~~IFPRD~~ IFRPD staff. The participants of the pretest were provided with questionnaires in which they were asked (a) to compare the preparation with the new product to the traditional preparation with respect to taste, smell, colour and consistency, and (b) to make suggestions on possible improvements of the two preparations. Based on the results of this pretest one preparation for RDF and one for FPC were eliminated. These were the preparations which faired worst against their traditional counterparts. The remaining four recipes for RDF and four for FPC were then modified according to suggestions given by the participants of the pretest.

A final pretest was performed with two sub-samples, each of 20 respondents drawn from the final-test sample, in order to resolve procedural problems as well as to pretest the questionnaires. Based on the results of this last pretest, some additional, rather minor, modifications of the recipes were made. Two out of the four final recipes for each new product turned out to be based on the same traditional dish, while two were different. The local names of these preparations are:

RDF	FPC
Kaeng som	*Kaeng som*
Nam prik (pla ra)	*Nam prik (pla ra)*
Kaeng luang	*Kaeng kua*
Kaeng liang	*Kaeng kare*

The complete recipes for these preparations as modified after the final pretest are given in Appendix A.

1.3 Questionnaires

Based on the experience gained in other countries in which the acceptibility of FPC was tested and on information obtained through several pretests at IFRPD and with sub-samples of the final test sample, three questionnaires were prepared:

(i) socio-economic background and eating habits;

(ii) test of acceptability of recipes prepared with RDF and FPC;
(iii) assessment of the two new fish products.

The purpose of the first questionnaire is to obtain general information on the origin, age, education, family, income and eating habits of the respondents so that the relationship between these variables and the level of acceptability of the new fish products could be explored. For example, one may test the hypotheses that new products will be more acceptable among the lower income groups, among the young and among those who are more regular fish eaters. Since this background information, being respondent-specific, does not change from one test to the next, it was administered only once at the beginning. A copy of this questionnaire is reproduced as Appendix B to this report.

The second questionnaire constitutes the core of the project as it aims at determining the acceptability of the new preparations vis-a-vis the traditional ones and vis-a-vis each other, with regard to particular properties (smell, colour, taste and consistency) and total preference. This questionnaire also attempts to determine how much cost differences influence the respondents' level of acceptability of a given preparation. As this questionnaire is preparation-specific it was administered after every test or ten times in total : four times for the comparison of the four RDF preparations with their traditional counterparts; four times for the comparison of the four FPC preparations with their traditional counterparts; and, two times for the comparison of the common RDF, FPC preparations. A copy of this questionnaire is reproduced in this study as Appendix C.

The third questionnaire aims at obtaining an overall assessment of RDF and FPC after the completion of (all) their respective tests. As such it was administered only twice. The main information sought concerns the price levels at which the consumers are willing to buy the new product and the intended frequency of use. A copy of this questionnaire appears as Appendix D.

1.4 Site and Sample Selection

Two criteria were used in the site and sample selection: (a)

the representativeness of the sample, and (b) the convenience of the location of the site. While the first criterion requires a totally random sample drawn from the target low-income population, the second criterion dictates a single site conveniently located. As a compromise we chose two sites, a Jute Mill located about 30 kilometers outside Bangkok and Kasetsart University, drawing from each a large enough sample for statistically valid tests. The target sample was 200 workers from the Jute Mill and an equal number from Kasetsart University; however, only 179 from the former and 217 from the latter were available to participate. Of these, only 121 and 175 persons respectively participated in all the tests. The selected two sites had the added advantage that the management was willing to co-operate as both these establishments are government supported. Other sites visited proved unworkable because of the inconvinience of the working schedule (alternating shifts). A third site, the primary school at the (rural) Kampaengsaen Campus of Kasetsart University, was used for a limited testing among school-children.

CHAPTER 2

SOCIO-ECONOMIC BACKGROUND OF THE SAMPLE

2.1 Socio-Demographic Profile

As mentioned earlier, the total sample of 396 persons, is made up of 217 lower-rank staff (e.g unskilled workers, technicians and secretaries) of Kasetsart University and 179 factory workers from a Jute Mill in Pathum Thani province at the outskirts of Bangkok. Table.1 describes the socio-demographic profile of the sample. Over two-thirds of the Kasetsart sample and over 95 percent of the Jute-Mill sample were women. . Only few persons were below 20 or over 50 years of age while more than 80 percent of each sample were between 20 and 39 years old. Thus, the respondents were relatively young by comparison to the age structure of the general population and of the labor force.

It is significant to note that 27 percent of the Kasetsart sample and 87 percent of the Jute-Mill sample resided in the place of work. In-residents are lesslikely to live with their families or do their own cooking especially in the case of the factory workers. They purchase ready-made food, often from the same sources which may bring about certain uniformity of eating habits and tastes. While no attempt was made for a country-wide representation in the sample there were respondents from all four regions and the capital, though far from proportionate to their respective populations. Bangkok which accounted for almost half of the Kasetsart sample was over-represented; the rest of the Central-Region provinces, which accounted for 63 percent of the Jute Mill sample and 33 percent of the Kasetsart sample, were also over-represented. In contrast, too few respondents came from the Northeast and the South. Considering however, the similarities of diets between the North and the Northeast on the one hand and between the South and the Central Region on the other it can be said that some cross-section representation of preferences was attained. About 21 percent of the overall sample had its origin in the North and the Northeast, 50 percent in the Central Region (other than Bangkok) and the South, and 29 percent in Bangkok (see part D of Table 1)

Table 1. Socio-Demographic Profile of the Sample.

Socio-demographic characteristic	Kasetsart University		Jute Mill	
	Number	Percent	Number	Percent
Sample size	217	100.0	179	100.0
A. Sex				
Male	70	32.3	8	4.4
Female	147	67.7	171	95.6
No answer	-	-	-	-
B. Age				
Below 20	-	-	2	1.1
20 - 29	97	44.7	86	48.1
30 - 39	81	37.3	63	35.2
40 - 49	28	12.9	19	10.6
Over 50	11	5.1	7	3.9
No answer	-	-	2	3.9
C. Residence				
In place of work	59	27.2	156	87.2
Nearby	85	39.2	14	7.8
Bangkok	56	25.8	6	3.4
Elsewhere	17	7.8	1	0.6
No answer	-	-	2	1.1
D. Place of origin				
Bangkok	105	48.4	9	5.1
Central Plain	72	33.2	113	63.1
North	10	4.6	39	21.8
Northeast	17	7.8	14	7.8
South	13	6.0	4	2.2
No answer	-	-	-	-
E. Occupation				
Unskilled laborer	85	39.2	134	74.9
Uniform laborer	2	0.9	-	-
Service laborer	117	53.9	29	16.2

Table 1 (continued)

Socio-demographic Characteristic	Kasetsart University		Jute Mill	
	Number	Percent	Number	Percent
Professional	12	5.5	-	-
Business	1	0.5	2	1.1
Other	-	-	3	1.7
No answer	-	-	11	6.1
F. <u>Marital status</u>				
Single	38	17.5	99	55.3
Married	167	77.0	70	39.1
Divorced	12	5.5	9	5.1
No answer	-	-	1	0.6
G. <u>Members of household</u>				
One	12	5.5	57	31.8
2-3	53	24.4	23	12.9
4-5	80	36.9	44	24.6
6-7	43	19.8	33	18.4
Over 7	29	13.4	12	6.7
No answer	-	-	10	5.6
H. <u>Number of children</u>				
No children	10	4.6	107	60.0
1-2	100	46.1	47	26.3
3-4	42	19.4	17	9.5
5-6	11	5.1	3	1.7
Over six	1	0.5	3	1.7
No answer	53	24.4	2	1.1

Occupation-wise 54 percent of the Kasetsart respondents were service laborers and 39 percent unskilled workers. In contrast, 75 percent of the Jute-Mill respondents were unskilled workers and less than 20 percent had any skill. The majority of the sample at Kasetsart (77 percent) were married and had relatively large families. As many as 55 percent of the Jute Mill sample were single and a somewhat higher percentage(60 percent) had no children. (see parts F,G, and H of Table 1). These differences in marital status and family size between the two test sites may explain part of the difference in preferences between the two sites (as it will be seen in the sequel).

2.2 Eating Habits of the Respondents

In a country where fish is the most popular source of protein it is common for people to eat fish everyday. On the other hand, at the present level of Thailand's development, fish and other sources of animal protein are still considered a luxury by the lowest-income groups and are becoming increasingly so with the increase in fish prices. Thus, it is also common to encounter people who rarely eat fish. Moreover, pure differences in tastes, not related to incomes, can be found even in a basically fish-eating country. Differences in the frequency of fish consumption are expected to give rise to some variation in the preferences for new fish products, although it is difficult to theorize _a priori_ as to whether the regular or the not-so-regular fish eaters would have the higher preference for the new products. Table 2 reports that over 14 percent of the Kasetsart sample ate fish everyday while over 18 percent ate fish four-to-five times a week compared with 11.7 and 14.0 respectively for the Jute-Mill sample. Less than 10 percent of the former and over 17 percent of the latter ate fish, at most, twice a month. The majority, however, at both sites ate fish between one and three times a week.

Since the frequency of fish consumption depends on both taste and cost it is of interest to investigate to what extent lower fish prices would induce people to consume more fish. As seen from part B of Table 2, 83 percent at Kasetsart and 80 percent at the Jute-Mill expressed their desire to eat more fish at lower prices. This significant price responsiveness lends support to the hypothesis that

Table 2. Frequency Distribution of Sample According to Fish-Eating Habits

Socio-demographic Characteristic	Kasetsart University		Jute Mill	
	Number	Percent	Number	Percent
Sample size	217	100.0	179	100.0
A. Fish-eating frequency				
Every day	31	14.3	21	11.7
4-5 times a week	40	18.4	25	14.0
2-3 times a week	87	40.1	74	41.3
Once a week	38	17.5	27	15.1
Twice a month	12	5.5	10	5.6
Rarely	9	4.1	21	11.7
No answer	-	-	1	0.6
B. Response to lower fish prices				
Eat more fish	180	82.9	143	79.9
No change	37	17.1	35	19.6
No answer	-	-	1	0.6
C. Preferences: fish vs. meat*				
Prefer fish	63	29.0	45	25.1
Indifferent	138	63.6	99	55.3
Prefer meat	16	7.4	32	17.9
No answer	-	-	3	1.7
D. 1st Most frequently consumed fish species				
Mackerel	152	70.0	130	72.6
Snakehead fish	41	18.9	33	18.4
One-eye fish	6	2.8	2	1.1
Red snapper	4	1.8	3	1.7
Blackbanded king fish	3	1.4	2	1.1
Other	12	5.5	6	3.4
No answer	-		3	1.7

Table 2. (continued)

Socio-demographic Characteristic	Kasetsart University		Jute Mill	
	Number	Percent	Number	Percent
E. 2nd Most frequently consumed fish species				
Mackerel	47	21.7	32	17.9
Snakehead fish	101	46.6	101	56.4
One-eye fish	21	9.7	10	5.6
Red snapper	12	5.5	21	11.7
Blackbanded king fish	10	4.6	1	0.6
Other	12	5.5	9	5.0
No answer	14	6.5	5	2.8
F. 1st Most frequently consumed form				
Fresh	174	80.2	107	59.8
Dried	14	6.5	16	8.9
Smoked	1	4.6	5	2.8
Fermented	7	3.2	22	12.3
Salted	20	9.2	19	10.6
Other	-	-	2	1.1
No answer	2	5.5	8	4.5
G. 2nd Most frequently consumed form				
Fresh	15	6.9	21	11.7
Dried	57	26.3	39	21.8
Smoked	24	11.1	27	15.1
Fermented	43	19.8	27	15.1
Salted	73	33.6	47	26.3
Other	1	4.6	1	0.6
No answer	4	1.8	17	9.5

Table 2. (continued)

Socio-demographic Characteristic	Kasetsart University		Jute Mill	
	Number	Percent	Number	Percent
H. 1st Most frequently consumed fish dishes				
Kaeng som	107	49.3	82	45.8
Kaeng phet	15	6.9	34	19.0
Phat pla	3	1.4	7	3.9
Tom yam pla	21	9.7	9	5.0
Nam prik	26	17.0	18	10.1
Pla thod	43	19.8	22	12.3
Pla nung	4	1.8	-	
Other	1	.46	1	0.6
No answer	-		7	3.9
I. 2nd Most frequently consumed fish dish				
Kaeng som	35	16.1	29	16.2
Kaeng Phet	44	20.2	48	26.8
Phat pla	16	7.4	23	12.8
Tom yam pla	47	21.7	28	15.6
Nam prik	30	13.8	21	11.7
Pla thod	41	18.9	14	7.8
Pla nung	6	2.8	4	2.2
Other	-		1	6.6
No answer	219		11	6.1

Table 2. (continued)

Socio-demographic Characteristic	Kasetsart University		Jute Mill	
	Number	Percent	Number	Percent
J. Food Preparation				
The respondent (regularly)	99	45.6	50	27.9
Other household members (regularly)	50	23.0	17	9.5
Purchase ready-cooked food always	3	1.4	44	24.6
Purchase ready-cooked food occasionally	65	30.0	66	36.9
No answer	1	.46	2	1.1
K. Frequency of trying new preparations				
Often	72	33.2	93	52.0
Occasionally	138	63.6	82	45.8
Rarely	7	3.2	2	1.1
No answer	-		2	1.1
L. Preference for food texture				
Prefer big bits of fish	53	24.4	54	30.2
Indifferent	163	75.1	123	68.7
No answer	1	.46	2	1.1
M. Seasonality of fish consumption				
Seasonal	62	28.6	89	49.7
All year round	155	71.4	88	49.1
No answer	-		2	1.1

the wide variation in the frequency of fish consumption observed is due more to economic factors (incomes and prices) than to difference in tastes. This is an encouraging finding in that it reveals a wide scope for introduction of new, lower-priced fish products to increase protein intake.

It is sometimes argued that fish is an inferior good as compared to meat: higher incomes or lower fish prices may, in fact, bring about a substitution of meat for fish. However, most respondents at each testing site expressed indifference between the two while over one fourth expressed preference for fish (see part C of Table 2)

The most frequently consumed species by the majority in the sample, 70 percent at Kasetsart, and 73 percent at the Jute Mill, was spanish mackerel (a marine species known locally *platoo*) followed by snakehead-fish or ophiocephalus (a freshwater species known locally as *plachon*) which was reported by 18 percent of the total sample as their first choice and by about 50 percent as their second choice after mackerel (see parts D and E of Table 2). Fish was most frequently consumed fresh by 80 percent of the respondents at Kasetsart and by 60 percent of the respondents at the Jute Mill. The next most preferred forms were 'salted' 'dried' and 'fermented' in that order, as shown in parts F and G of Table 2. The most popular fish preparation was *kaeng som* a fish-and-mixed vegetable dish (see Appendix A) which is one of the traditional Thai dishes we use in the test.

Housewives were chosen as the target group for the test of the new fish products because they combined the functions of both the consumer and the producer of food. As cooks, housewives are expected to be more sensitive to both fine differences in taste and in costs. Moreover, housewives are expected to be the potential users of the new products. Thus, it is of interest to determine what percentage of the respondents were doing their own cooking. Only 45.6 percent of the Kasetsart sample and 27.9 of the Jute-Mill sample were doing their own cooking on a regular basis. The rest either had others prepare the meals for them or purchased ready-cooked food (see part J of Table 2). It is not surprising that a smaller

percentage at the Jute Mill than at Kasetsart were involved in cooking since the former were in-residents at the factory.

Another factor which was thought of importance in relation to the acceptability of the new products was the frequency with which the respondents have being trying new preparations. The factory workers were found to be more adventurous in their eating habits, as over half of them reported trying new preparations often, compared to only one-third among the University laborers (see part K of Table 2). On the other hand a larger percentage among factory workers expressed a preference for 'big bits' of fish over ground fish (see part L of Table 2).

Fish is a commodity subject to seasonal fluctuations. The supply of marine fish is affected by the monsoons while the supply of freshwater fish is affected by droughts and floods. Moreover during the rice-harvesting season considerable quantities of fish are obtained from the rice fields with consequent downward pressure on fish prices. Those of the consumers who can barely afford to buy fish they are content to eat it only when they can catch it by themselves or when prices are relatively low. The seasonal of fish consumption suggests the need for the introduction of low-priced fish products that would be available all-year-round or at least during the 'off-fishing' season. About 50 percent of the sampled factory workers and 29 percent of the sampled university staff reported seasonal variations in their fish consumption (see part M of Table 2). The higher percentage in the case of the factory workers is to be expected in the light of their considerably lower-income than Kasetsart staff as we will see in the following section.

2.3 Socioeconomic Conditions

As the new fish products are intended for low-income socioeconomic groups with inadequate protein intake, it is useful to describe the pertinent socio-economic conditions of the sampled population. Since one may get more accurate data on expenditures than on incomes and since at very low-income levels total expenditure and income are almost identical, Table 3 reports the frequency distribution of

Table 3. Socio-economic Conditions of the Sampled Population: Expenditure on Fish, Food, and All Items Combined.

	Kasetsart University		Jute Mill	
	Number	Percent	Number	Percent
Sample size	217	100.0	179	100.0
A. Total expe[illegible]iture (monthly)				
≤ 500 baht	1	0.5	43	24.0
501-1,000 "	9	4.1	36	20.1
1,001-1,500 "	37	17.1	14	7.8
1,501-3,000 "	87	40.1	22	12.3
Over 3,000 "	49	22.6	6	3.4
Incomplete answer	34	15.7	58	32.4
B. Expenditure on food (monthly)				
Below 500 Baht	1	0.5	64	35.8
501-1,000 "	49	22.6	33	18.4
1,001-1,000 "	65	30.0	19	9.4
Over 1,500 "	68	31.3	5	2.8
Incomplete answer	34	15.7	58	32.4
C. Engel's coefficient[1]				
≤ 0.50	43	29.8	35	20.0
0.51-0.65	52	24.0	34	19.6
> 0.65	88	40.6	52	29.1
Incomplete answer	34	15.7	58	32.4
D. Expenditure on fish (monthly)				
≤ 100	14	6.5	91	50.8
100-200	46	21.2	24	13.4
200-300	51	23.5	6	3.4
> 300	72	31.2	-	-
No answer	34	15.7	58	32.4

Table 3. (continued)

	Kasetsart University		Jute Mill	
	Number	Percent	Number	Percent
E. Expenditure on fish ÷ food expenditure				
0.156	35	16.1	67	37.4
0.157 - 0.223	47	21.6	23	12.8
0.223	101	46.5	31	17.3
Incomplete information	34	15.7	58	32.4
F. Consumption of own catch (monthly)				
Zero	177	81.6	144	80.4
1 - 5 kg.	20	9.2	19	10.6
Over 5 kg.	20	9.2	13	7.3
No answer	-	-	3	1.4
G. Non-cash income-food (monthly)				
Zero	193	88.9	138	77.1
1 - 99 baht	6	2.8	7	4.7
100 - 999 "	17	7.8	21	11.7
≥ 1,000 "	1	0.5	7	3.9
No answer	-	-	6	0.3

F. Averages

	Kasetsart University	Jute Mill
	Baht	Baht
Average total expenditure (monthly)	2,481	1,027
Average expenditure on food (monthly)	1,462	605
Average expenditure on fish (monthly)	325	82
Average Engel's coefficient	0.630	0.620
Average ratio of expenditure on fish to total expenditure	0.222	0.136
Average family size	4.87	3.15
Total Expenditure per Capita (monthly)	509	326
Food Expenditure per Capita (monthly)	300	192
Fish Expenditure per Capita (monthly)	67	26

1 Engels coefficient = expenditure on food ÷ total expenditure

related expenditures. It is evident that the Jute-Mill sample is the lowest-income group among the two : over 44 percent had total expenditures of 1,000 baht per month or less, compared to barely 5 percent in the case of Kasetsart. Almost 50 percent of the latter sample had incomes in excess of 3,000 baht compared to less than 4 percent in the case of the Jute Mill. It is also worth noting the high percentages who gave incomplete answers, especially among the Jute-Mill workers.

The average total expenditure per household was 2,481 for Kasetsart and 1,027 baht for the Jute Mill (see Table 3). It should be recalled, however, that 87 percent were in-residents, 55 percent were single and about 32 percent lived in a single-person households; the respective percentages for Kasetsart were 27, 18 and 6 percent (see Table 1). In per capita terms, the monthly total expenditure was approximately 509 baht for Kasetsart and 326 baht for the Jute Mill. These figures may be compared to the national average. Unfortunately, no recent figures on either consumption expenditure or per capita income are available. The latest completed Household Expenditure Survey 1975-76 reports an average cash expenditure per capita of 500 baht per month for the urban areas and 205 baht for the rural areas with a national average of 326.* Considering that both Kasetsart and the Jute Mill are located in the environs of Bangkok and that considerable inflation took place since 1975-76 we may conclude that both the samples have expenditures (and incomes) below the urban national average. Moreover, the average income at the Jute Mill is perhaps somewhat below the poverty line defined for municipal areas at 247 baht / person / month at 1975-76 prices, which comes to about 370 baht if we assume a 50 percent inflation between 1975-76 and 1980.

Expenditure on food is another pertinent indicator of socio-economic conditions. As expected, the Jute-Mill workers spent considerably less both per household and per capita than their counterparts at Kasetsart University (see parts B and F of Table 3). The Engels' coefficient, defined as the ratio of food expenditure to total

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*Socioeconomic Survey 1975/76, National Statistical Office, Regional Volumes, Tables 4 and 1.

expenditure, is relatively high in both samples, over 60 percent compared to the national average of 50.9 for 1978.* However, at first glance it is surprising that the Engels' coefficient for the Jute Mill sample is not significantly higher than that of Kasetsart, since the lower income is, the higher the percentage spent on food. However, this can be explained by the fact that the Jute Mill workers receive free rice for three meals a day as opposed to the Kasetsart workers who are each responsible for his own meal. The monthly food expenditure per capita was 300 baht at Kasetsart and 192 baht at the Jute Mill.

As fish is a semi-luxury item, especially for low-income groups we would expect the Kasetsart workers to have spent proportionately more on fish and less on cereals than the Jute-Mill group. Indeed, Kasetsart workers spent on fish 4 times more than the Jute Mill workers compared to only 2.4 times more on food in general. Over half of the Jute-Mill sample spent 100 baht or less per month on fish and no one spent over 300 baht. In contrast, less than 7 percent of the Kasetsart workers spent on fish 100 baht or less while 31 percent spent over 300 baht per month (see parts D and F of Table 3). As much as 22.2 percent of the total expenditure of the Kasetsart workers was spent on fish compared to only 13.6 percent of the factory workers. The monthly capita expenditure on fish was 67 baht for Kasetsart and 26 baht for the Jute Mill.

As mentioned earlier, it is not uncommon in Thailand for consumers especially those living in rural areas to obtain fish supplies directly from the rivers and canals. To the extent that this is true of our sample, the expenditure on fish understates fish consumption. It was found that approximately 20 percent of each sample had obtained part of their fish consumption directly from the natural source, but no significant difference between the two sites was observed (see part F of Table 3). In addition to this non-cash form of income other non-cash sources included consumption of own production of rice, vegetables

*Selected Economic Indicators Relating to Agriculture 1979, Office of Agricultural Economics.

and poultry as well as other food and necessities supplied 'at no cost' by relatives. As seen from part G of Table 3, the factory workers have considerably more non-cash income than the University laborers. This could be explained partly by their greater need for supplementary income and partly by their greater opportunity for such income as most factory workers came from the rural areas where they left families occupied in farming and livestock.

CHAPTER 3

ANALYTICAL FRAMEWORK

1. Test Procedure

In total, ten tests were conducted at each site, using the recipes and questionnaires described in Chapter 1 and Appendixes A to D. In each of the first four tests a popular Thai dish, now prepared with Roller Dried Fish (henceforth RDF for brevity) was served side-by-side with the corresponding traditional dish (henceforth traditional). In each of the next five tests a popular Thai dish now prepared with Fish Protein Concentrate (henceforth FPC) was served side-by-side with the corresponding traditional dish. During the last two tests two dishes common to the preceeding RDF and FPC tests were served for direct comparison between the two new products. The respondents were requested to state their preferences with respect to colour, consistency, taste and smell as well as their overall preference at different sets of relative prices (see Appendix C). Suggestions on possible improvements of the recipes were solicited for future reference.* Finally, as the contesting preparations were served (along with a third non-fish dish and dessert) as a full meal for lunch, the leftover amounts were considered as indicators of revealed acceptability/preference and were carefully estimated (though not weighed) and recorded. After all four tests for each new fish product were completed, the respondents were asked to make an overall assessment of the product stating the intended frequency of use at different prices and their opinion as to the fair price (see Appendix D).

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*Note that these suggestions were not used for modifying recipes during Phase I in order to preserve the uniformity and constancy of recipes throughout the test.

2. <u>Concepts and Definitions</u>: <u>Indexes of Acceptability</u>

The objective of this project is to determine the acceptability of Roller-Dried Fish and Fish Protein Concentrate incorporated in popular Thai dishes, Hence the term 'acceptability' needs to be defined. Conventionally, something is termed 'acceptability' if it is considered satisfactory in the sense that it meets the minimum requirements. In the case of food,'acceptable' means (merely) edible or fair. While this conventional meaning is useful as the lower bound of the set of 'all acceptable elements' it gives no indication of the intensity of preference among these elements: it groups the exceptionally good with the merely tolerable. Similarly the term 'unacceptable' lumps together all unsatisfactory elements regardless of intensity of dislike.

A second problem with the conventional 'acceptability' is that no indication is given as to whether something is acceptable in an absolute or a relative sense, in a physical or an economic sense. It is known, however, that things, which are acceptable when considered individually, may be unacceptable when compared to superior alternatives. Moreover, an object, whose physical properties are acceptable, may be unacceptable on economic grounds (too expensive relative to its worth to the consumer).

In order to incorporate the intensity of preference in an operational concept, an <u>index of acceptability</u> was constructed. If the particular dish or product is exceptionally liked is given the value 1.00 (or 100%), while if it is exceptionally disliked is given the value 0.00 (or 0%). In the middle there is the conventional meaning of acceptability 0.50 (or 50%), i.e. the preparation is edible or fair. In mid-distance between 0.50 and 1.00 we may insert a value which is 'much liked' but not exceptional : 0.75 (or 75%); Similarly between 0.00 and 0.50 we may insert a value which is unacceptable but not 'hated' : 0.25 (or 25%). This index may be pictured graphically as follows:

Not at all	Not much	Fair	Much	Very much	
0.00	0.25	0.50	0.75	1.00	(3.1)

The degree of like or dislike of a given item by a single individual is only one aspect of the intensity of preference. The other aspect is the percentage from a given sample that have a particular preference: the higher this percentage, the higher the intensity of perference or dislike. The most popular item is the one which is liked 'very much' by '100 percent' of the sample, while the least popular is the one which is 'not at all' liked by '100 percent' of the sample. Thus, in order to obtain a complete index of acceptability, the intensity of individual preference is weighed (multiplied) by the percentage of the sample having each preference and summed up over all preferences:

$$A = \sum_{i=1}^{5} x_i \frac{n_i}{N} \quad \text{or} \quad A = \frac{\sum_{i=1}^{5} x_i q_i}{100} \quad \text{for } i = 1, 2, \ldots, 5 \qquad (3.2)$$

where: A is the (complete) index of acceptability (henceforth index);

x_i is the intensity of (individual) preference taking discrete values 0.00, 0.25, 0.50, 0.75 and 1.00 corresponding to 'not at all', 'not much', 'fair', 'much' and 'very much' respectively;

n_i is the number of persons having intensity of preference x_i;

N is the total sample and, $q_i = n_i/N$ is the percentage of the sample having intensity of preference, x_i.

The highest value that index A can obtain is 1.00 which indicates that the item concerned is 'liked very much by everyone'; The lowest value is 0.00 which means it is 'disliked intensively by everyone'. The mid-distance, 0.50, between the lowest and highest value is still the borderline between the acceptable and the unacceptable; it indicates that the item concerned is considered 'fair'. A value of 0.50 may result from 100 percent 'fair', or from 50 percent 'very much' and 50 percent 'not at all' or from 50 percent 'much' and 50 percent 'not much'; other combinations, such as 50 percent 'much', 25 percent 'fair' and 25 percent 'not at all' also result in an index of 0.50. Note that while x_i is a discrete variable, index A is continuous and can take any number between 0.00 and 1.00. A value of 0.625, for

instance, is possible and may be interpreted as indicating that the item concerned is considered better than 'fair' but yet it is not among the items liked 'much'.

Index A is an index of absolute acceptability in the sense that the item concerned is judged individually without reference to its merits or demerits by comparison to other items. It simply tell us that item X is liked very much or item Y is not liked at all. However, the introduction of new fish products is done in a background of traditional fish products against which the merits of the new products are assessed. To meet this need for evaluating one item against another the index of relative acceptability is introduced and defined as:

$$R_{jk} = \frac{A_j}{A_k} \tag{3.3}$$

where: R_{jk} is the index of relative acceptability of item j with respect to item k;

A_j is the index of absolute acceptability of item j; and,

A_k is the index of absolute acceptability of item k.

Index R has the desirable property that when j = k, R_{jk} (which now becomes R_{jj}) = 1 i.e. the relative acceptability of a product with respect to itself is one. Similarly if two products are equally liked R_{jk} takes the value of one. A value of R_{jk} greater than one means that product j is liked more than product k, if, on the other hand, R_{jk} is less than one the reverse is true. A value of 0.50 may be interpreted as 'product j is liked half as much as product k'. A value approaching zero means item j is not at all liked by comparison to item k, and so on.

Indexes A and R are both indexes of physical acceptability. They indicate the degree to which some aspect (partial index) or all aspects (total index) of an item is liked either by itself or by comparison to some other item, regardless of relative prices. However, a major advantage of the new fish products is that they cost less than the traditional products. There is also a price differential between

the two new products with FPC costing approximately have as much as RDF. Generally speaking the lower the price the higher the degree of acceptability (within limits). First, we would like to know what percentage of the sample will choose a new preparation over a traditional one if the two preparations or products bear the same price; some respondents might be indifferent between the two items which is also to the credit of the new product because of its 'newness' and its lower production cost. In general, the percentage of the sample which prefers a given item over another (or is indifferent between the two) at a given set of relative prices may be used as an index of economic acceptability:

$$E_j = \frac{n_j}{N} \Big|_{P_j = \alpha P_k} \quad \text{or} \quad E_j' = \frac{n_j + n_{jk}}{N} \Big|_{P_j = \alpha P_k} \qquad (3.4)$$

where: E_j is the index of economic acceptability of product j; E_j' is a modified index of economic acceptability counting indifference between two items as preference for the new item);

n_j is the number of respondents prefering item j over item k;

n_{jk} is the number of the respondents who are indifferent between item j and item k;

N is the size of the sample;

P_j is the price of item j;

P_k is the price of item k; and,

α is a constant equal to the ratio P_j/P_k.

Second, we would like to know the price responsiveness of the preference for each item. For example if the price of a new product is reduced by 25 percent, i.e. it is only 75 percent of the price of the traditional product, would the index of (economic) acceptability change and by how much? Based on the law of demand, which states that demand varies inversely with the price, we would expect acceptability to increase with the reduction of the price. The magnitude of the increase, however, differs from one case to another depending, on tastes and habits, availability of close substitutes, the level of the price and

the magnitude of the price change. The price elasticity of acceptability (a concept akin to the price elasticity of demand) gives the percentage rate of change in the (economic) acceptability of a product as a result of a one percent change in its price i.e.

$$\varepsilon_j = \frac{\%\text{ change in acceptability}}{\%\text{ change in price}} = \frac{\Delta E_j}{\Delta P_j} \cdot \frac{P_j}{E_j} \qquad (3.5)$$

Where: ε is the price elasticity of acceptability of item j;
E_j is the index of economic acceptability of item j;
P_j is the price of item j before the change;
ΔP_j is the magnitude of the price change; and
ΔE_j is the (consequent) change in the mangnitude of E_j. For instance, if at $P_j = 10$ $E_j = 50$ while at $P_j = 8$ $E_j = 60$ (i.e. $\Delta P_j = -2$ causes a $\Delta E_j = 10$) the elasticity of acceptability is equal to -1.00.

All concepts of acceptability defined above were based on explicit statements by the respondents who tasted and compared the various food preparations presented to them. However, something can also be learned by studying the observed behavior of the respondents. As these food preparations were served in lieu of lunch, large quantity of leftovers may indicate unacceptability while no leftovers at all may indicate the reverse. As mentioned earlier, the amount of leftovers from each preparation by each respondent was estimated and recorded. To construct an index of <u>revealed acceptability</u> we use exactly the same method as we did for the absolute physical acceptability (see formulas (3.1) and (3.2) above) except that we used the amount of leftovers by each respondent instead of the intensity of individual preference. Leftovers of between zero and one-fifth of the serving were considered equivalent to liking the dish 'very much' and were assigned the value 1.00, while leftovers of one-half of the serving were considered equivalent to fair' and so forth as shown graphically below:

Not at all	Not much	Fair	Much	Very much	(3.6)
0.00	0.25	0.50	0.75	1.00	
$\ell > \frac{3}{4}$	$\frac{3}{4} > \ell > \frac{1}{2}$	$\ell = \frac{1}{2}$	$\frac{1}{2} > \ell > \frac{1}{5}$	$\ell < \frac{1}{5}$	

where 'ℓ' stands for leftovers.

Then, the index of revealed acceptability V_j is given by the index of leftovers weighed (multiplied) by the percentage of the sample for which the particular amount of leftovers was observed and summed up:

$$V_j = \sum_{i=1}^{5} \frac{z_i\, n_i}{N} \qquad \text{for } i = 1, 2, \ldots, 5 \tag{3.7}$$

where z_i is the index of leftovers taking the values 0.00, 0.25, 0.50 0.75 and 1.00 as indicated in formula (3.6) above;

n_i is the number of the respondents corresponding to z_i, and

N is the sample size.

There is, however, one serious problem with using leftovers as indicators of acceptability. Some respondents may have left a large quantity of leftovers not because they disliked the particular preparation but simply because they were not hungry; similarly, other respondents may have left few leftovers not because of intensive preference but because of intensive hunger at the moment. It is, thus more meaningful to use a relative index of revealed acceptability obtained in a manner analogous with index (3.3) above:

$$W_{jk} = \frac{V_j}{V_k} \tag{3.8}$$

where W_{ij} is the relative index of revealed acceptability of preparation j with respect to preparation k; and,

V_j and V_k are absolute indexes for preparations j and k respectively defined by equation (3.7) above.

This last index assigns importance not to the absolute amount of the leftover but on its relative magnitude in comparison to the alternative with which is compared. Even with more than half of the serving being leftover a new preparation may still be acceptable if more was left over from the traditional preparation.

To sum up, the following concepts of acceptability have been introduced and defined:

(1) absolute physical acceptability indicates the expressed intensity of like or dislike, by the sample as a whole, of the physical properties of a given item regardless of its price or of the presence of alternatives;

(2) relative physical acceptability: indicates the relative intensity of preference, by the sample as a whole, between two alternatives regardless of their relative prices;

(3) economic acceptability: indicates the intensity of preference, by the sample as a whole, between two items given their relative prices; congenial to this concept is the elasticity of acceptability which indicates the degree of responsiveness of economic acceptability to price changes.

(4) revealed acceptability: in its absolute form it indicates the amount of leftovers from a given item by the sample as whole; in its relative form it indicates the relative preference for the two items as revealed in the relative amounts of leftovers.

These concepts were made operational by construction of ~~tative~~ indexes, which enable both cardinal and ordinal rankings of the food preparations, the recipes and the fish products. However, it should not be expected that these indexes would give identical results. Each concept is based on a different premise than the rest and is intended to convey a different type of information: concept (1) ignores the existence of alternatives and the role of prices; concept (2) brings in alternatives but still it ignores prices; concept (3) brings in alternatives and their relative prices; concept (4) is analogous to concepts (1) and (3) but not as exact though it has the advantage of being based on actual behavior. Of course, the more indexes rank a given product at the same position the more confident we become as to the degree of its acceptability or unacceptability. Inreconcilable conflicts between the various indexes (concepts) may be a sign of weak acceptability. However, some precedence ought to be given to the indexes of taste and economic acceptability. The results of the acceptability tests analysed within the framework described above are reported in Chapter 4 for RDF and Chapter 5 for FPC.

As mentioned earlier, after the completion of the testing of the recipes for each new product vis-a-vis its traditional counterpart the respondents were ask to make an overall assessment and suggest a fair price for each product as well as indicate, the intended type and frequency of use. This gave yet another opportunity for ranking the various recipes, which may or may not agree with the results obtained during the test. In testing the various recipes the respondents based their preferences on their own tastes alone while, when they were asked how they would use the product at home, they probably took into account their family's tastes as well.

In addition to the indirect comparison which is possible between the two new products based on their performance vis-a-vis their traditional counterparts a direct comparison between RDF and FPC was also made using the same concepts of acceptability described above, and substituting RDF for the traditional product. The results are reported in Chapter 6.

3.3 The Regression Equation

In order to investigate the relationship between the respondents' socio-economic background, described in Chapter 2, and their preferences between the new and traditional products, to be described in the Chapters 4-6, the following procedure was employed. First a random sub-sample of 50 respondents from each sample was drawn and stratified into groups according to the demographic structure, the eating habits, and the economic conditions of the respondents; then, the various indexes of acceptability for these groups were calculated and compared. As significant differences between groups were observed an attempt was made to determine what percentage of the variation in the index of acceptability among the respondents could be explained by socio-economic variables and which of these variables were statistically the most significant. To do this, the following function was specified expressing an individual's intensity of preference or acceptability of a new product as a function of: (i) his acceptability of the tested preparations in their traditional form; (ii) his income or expenditure on various items, including fish; (iii) the price responsiveness of the

respondent's demand for fish; (iv) his eating habits; and, (v) his demographic characteristics, i.e.

$$X_j = f(X_k\ Y,\ P,\ T,\ D) \qquad (3.9)$$

where X_j is the respondent's intensity of preference for product j (new) obtained as $\sum_{m=1}^{4} x_{mj}$ where x_{mj} is his intensity of preference for the individual preparations in which the product j was incorporated;

X_k is the respondent's intensity of preference for product k (traditional) obtained in a manner analogous to X_j;

Y is a vector of income-or expenditure-related vairables;

P is a dummy (0 , 1) variable indicating the price responsiveness of the individual's demand for fish;

T is a set of dummy variables representing tastes and eating habits; and,

D is a vector of demographic dummy variables, such as sex, age, marital status, residence, origin and location and type of work.

Function (3.9) was, then, specified as a linear regression equation with an error term, ε_j:

$$X_j = \alpha_o + \alpha_1 X_k + \beta_1 Y_1 + \beta_2 Y_2 + \ldots + \gamma P + \delta_1 T_1 + \delta_2 T_2 + \ldots + \theta_1 D_1 + \theta_2 D_2 + \ldots + \varepsilon_j \qquad (3.10)$$

where $\alpha_o, \alpha_1, \beta_1, \beta_2, \ldots, \gamma, \delta_1, \delta_2, \ldots, \theta_1, \theta_2, \ldots$ are parameters to be estimated. Equation (3.9) was estimated using stepwise linear regression techniques. Based on the t-ratios (i.e. the size of the parameters relative to the size of the corresponding standard errors), the statistical significance of the explanatory variables was determined. The overall significance of the model was judged on the basis of the R^2 statistic, that is, the proportion of variation in the dependent variable (acceptability) explained by the independent or explanatory variables. The empirical results are reported in Chapter 7.

CHAPTER 4

ACCEPTABILITY OF ROLLER-DRIED FISH

4.1 Physical Acceptability

As explained in the preceeding chapter the index of absolute physical acceptability of a given food preparation indicates the degree of desirability of its physical properties(colour, consistency, taste and smell) regardless of price or alternatives. An index of 1.00 indicates that the preparation is liked 'very much' an index of 0.50 that it is 'fair' (barely acceptable); and, an index of 0.00 that it is decisively 'unacceptable'. The indexes of absolute physical acceptability of four popular Thai dishes in both their traditional and RDF forms have been calculated separately for the two sample sites, Kasetsart and Jute Mill, according to formula (3.2); the results are reported in Table 4 along with rank, site average, and combined average. The local names of the four dishes are *kaeng som, kaeng luang, nam prik* and *kaeng liang*, and their recipes are found in Appendix A. The indexes of relative physical acceptability of these four dishes were calculated as the ratio of the absolute acceptabilities of RDF and traditional dishes (see formula 3.3) and reported in the same Table along with rank and totals. An index of 1.00 means that the preparation with RDF is liked as much as the traditional preparation, while an index of 0.50 that it is liked 'half' as much.

4.1.1 Colour

As seen from section A of Table 4 the index of absolute acceptability of the colour of the traditional preparations ranges between 0.843 for *nam prik* at the Jute Mill to 0.734 for *kaeng luang* at Kasetsart while the colour of the RDF dishes ranges from 0.704 for KAENG LIANG at Kasetsart to 0.522 for *kaeng luang* at the Jute Mill. This means that colour-wise the traditional preparations were liked between 'much' and 'very much', while the RDF preparations ranged between 'fair' and 'much'. The two most popular RDF preparations with respect to colour were *nam prik* and *kaeng liang*.

The index of relative acceptability of the RDF preparation with respect to colour ranged between 0.924 for *kaeng liang* at Kasetsart to 0.632 for *kaeng luang* at the Jute Mill. Overall *kaeng liang*

Table 4. Physical Acceptability of Roller-Dried Fish

Acceptability index	Kasetsart University					Jute Mill					Combined average total
	Kaeng som	*Kaeng luang*	*Nam prik*	*Kaeng liang*	Total average	*Kaeng som*	*Kaeng luang*	*Nam prik*	*Kaeng liang*	Total average	
A. <u>Colour</u>											
Absolute index of TRD	.765	.734	.791	.762	.763	.760	.826	.843	.840	.817	.790
-rank	5	8	4	6	-	7	3	1	2	-	-
Absolute index of RDF	.644	.579	.677	.704	.649	.572	.522	.668	.617	.608	.629
-rank	4	6	3	1	-	7	8	2	5	-	-
Relative index of RDF	.842	.789	.843	.924	.850	.753	.632	.792	.735	.744	.796
-rank	3	5	2	1	-	6	8	4	7	-	-
B. <u>Consistency</u>											
Absolute index of TRD	.810	.779	.734	.829	.738	.809	.841	.826	.835	.828	.306
-rank	5	7	8	3	-	6	1	4	2	-	-
Absolute index of RDF	.639	.580	.616	.697	.633	.605	.578	.686	.625	.624	.629
-rank	3	7	6	1	-	5	8	2	4	-	-
Relative index of RDF	.789	.745	.839	.841	.808	.748	.687	.831	.749	.753	.780
-rank	4	7	2	1	-	6	8	3	5	-	-
C. <u>Taste</u>											
Absolute index of TRD	.814	.778	.775	.772	.785	.788	.814	.828	.859	.822	.804
-rank	3	5	6	7	-	4	3	2	1	-	-
Absolute index of RDF	.567	.552	.537	.686	.586	.600	.524	.668	.601	.598	.592
-rank	5	6	7	1	-	3	8	2	4	-	-
Relative index of RDF	.697	.710	.693	.889	.746	.761	.644	.807	.700	.728	.736
-rank	6	4	7	1	-	3	8	2	5	-	-

Table 4 (continued)

Acceptability index	Kasetsart University					Jute Mill					Combined
	Kaeng som	*Kaeng luang*	*Nam prik*	*Kaeng liang*	Total average	*Kaeng som*	*Kaeng luang*	*Nam prik*	*Kaeng liang*	Total average	average total
D. <u>Smell</u>											
Absolute index of TRD	.769	.742	.789	.741	.760	.778	.761	.793	.814	.787	.774
-rank	5	7	3	8	-	4	6	2	1	-	-
Absolute index of RDF	.558	.547	.588	.675	.592	.603	.556	.655	.617	.608	.600
-rank	6	8	5	1	-	4	7	2	3	-	-
Relative index of RDF	.726	.737	.745	.911	.780	.778	.731	.826	.753	.773	.776
-rank	8	6	5	1	-	3	7	2	4	-	-
E. <u>Total average</u>											
Absolute index of TRD	.790	.758	.772	.775	.774	.784	.811	.823	.837	.814	.794
-rank	4	8	7	6	-	5	3	2	1	-	-
Absolute index of RDF	.602	.565	.602	.691	.615	.596	.545	.669	.615	.606	.611
-rank	4	6	4	1	-	5	7	2	3	-	-
Relative index of RDF	.762	.745	.780	.892	.810	.760	.672	.813	.735	.744	.775
-rank	4	6	3	1	-	5	8	2	7	-	-

TRD: Traditional (preparation)

RDF: Roller-Dried Fish

Source: Computed according to formulas (3.2) and (3.3) from the figures given in Appendix E (Table E.1)

(0.830) and *nam prik* (0.818) fared best against their traditional counterparts. Recall that, except for a reversal in order, these were also the dishes with the most acceptable colour in absolute terms. It is noteworthy that the Kasetsart respondents, though prefering the colour of traditional *nam prik,* found little difference between the colours of the RDF and traditional *kaeng liang.* RDF appears to give *kaeng luang* the least desirable colour, though still 'acceptable' (above 'fair').

4.1.2 Consistency

Part B of Table 4 indicates that the absolute index of consistency for the traditional preparations ranges between 0.841 for *kaeng luang* at the Jute Mill to 0.734 for *nam prik* at Kasetsart. The same index for the RDF preparations ranges between 0.697 for *kaeng liang* at Kasetsart to 0.578 for *kaeng luang* at the Jute Mill. Thus, the pattern of colour preferences carries over to consistency: the traditional dishes are liked more than 'much' but less than 'very much' and the new dishes more than 'fair' but less than 'much'. Overall,* among the RDF dishes *kaeng liang* (0.661 average for the two samples) and *nam prik* (0.651) are found to have the most preferable consistency, while *kaeng luang* (0.579) continues to be the least acceptable dish.

The relative index is highest for *kaeng liang* at Kasetsart and lowest for *kaeng luang* at the Jute Mill. Overall RDF *nam prik* (0.835) and RDF *kaeng liang* (0.795)fared best against their traditional counterparts, while *kaeng luang* (0.716) remains the weakest preparation

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*Henceforth, the term 'overall' is used to indicate the combined results of the two samples; the numbers which follow in parentheses indicate the average of two individual sample indexes for a specific preparation or for all preparations combined. The Tables report only total averages by sample and the combined total average, but they don't report the combined-sample average by preparation for reasons of brevity. They are, however, easily obtainable by summing the two sample indexes for a given preparation and dividing by two.

4.1.3 Taste

Taste is perhaps the most important aspect of any food preparation. If the taste is unacceptable, colour consistency and smell are of little consequence. As seen from part C of Table 4 the Kasetsart sample found *kaeng liang* (0.686) the RDF dish with the most palatable taste while the Jute-Mill sample opted for *nam prik* (0.668), which, surprisingly enough, was found of the least acceptable taste at Kasetsart. Overall, *kaeng liang* (0.644) ranked first followed at distance by *nam prik* (0.603) while *kaeng luang* remained at the bottom.

In relative terms, *kaeng liang* at Kasetsart and *nam prik* at the Jute Mill fared best; but both had poor performance at the other site. Overall,* the taste of *kaeng liang* (0.795) and *nam prik* (0.750) was found to be closest to the traditional preparations yet not as close as their respective indexes show. *Kaeng luang* tailed with 0.677 though it was the second best at Kasetsart because of very poor rating at the Jute Mill (0.644)

4.1.4 Smell

The ordering of RDF dishes with regard to smell was more or less the same as with the ordering of other aspects. As seen from part D of Table 4 among the RDF dishes *kaeng liang* (0.675) was the Kasetsart favorite and *nam prik* (0.655) the most preferable dish at the factory. *Kaeng luang* continued to be unchallenged as the least popular dish. Overall *kaeng liang* (0.646) had the most palatable smell followed by *nam prik* (0.622). The same order was obtained in terms of relative acceptability with RDF *kaeng liang* (0.911) at Kasetsart edging very close to its traditional counterpart. *Kaeng som* which, up to this point, was consistently at the third position, fared well against the traditional dish at the factory (0.778) but quite

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*The term 'overall' refers to the combined results of the two samples; the numbers that follow in parentheses are averages of the individual sample indexes for the indicated preparation (averages by preparation are not given in the Tables; see footnote on page 35 for further details).

poorly (0.726) at Kasetsart. Overall, however, *kaeng luang* remained the least acceptable RDF preparation.

4.1.5 All Aspects Combined

When all aspects(colour, consistency, taste and smell)were combined into one index of overall physical acceptability (see part E of Table 4) the following ordering was obtained (recall A is the absolute index and R the relative index of physical acceptability):

KASETSART

Dish	A	R
1. *kaeng liang*	0.691	0.892
2. *nam prik*	0.602	0.780
3. *kaeng som*	0.602	0.762
4. *kaeng luang*	0.565	0.745

JUTE MILL

Dish	A	R
1. *nam prik*	0.669	0.813
2. *kaeng liang*	0.615	0.735
3. *kaeng som*	0.596	0.760
4. *kaeng luang*	0.545	0.672

OVERALL SAMPLE

Dish	A	R
1. *kaeng liang*	0.653	0.814
2. *nam prik*	0.636	0.797
3. *kaeng som*	0.599	0.761
4. *kaeng luang*	0.555	0.709

Thus, based on physical acceptability alone all four RDF recipes were found to be acceptable (fair). None was less than 70 percent as well liked as its traditional counterpart. However, *kaeng liang* and *nam prik*, in that order, were found most acceptable. The Kasetsart respondents who were mostly skilled workers, with Bangkok origin, and relatively high incomes, prefered *kaeng liang* over any other dish prepared with RDF. The Jute-Mill respondents on the other hand, being mostly unskilled workers from the rural areas with relatively low incomes found *nam prik* with RDF as the most acceptable dish. Of all the aspects of RDF recipes(colour, consistency, taste and smell) taste

(0.592) was the least satisfactory aspect especially when compared to the traditional taste (0.804). The rating of smell for RDF was also relatively low (0.600). It is believed that, with minor improvements in the taste and smell of the product and of the recipes, the absolute acceptability index for *kaeng liang* and *nam prik* could easily reach 0.750 (liked 'much'). For ~~nam prik~~ kaeng liang many respondents suggested use of more fish, more chili paste, more pepper and less salt. For *nam prik* many respondents recommended the use of more fish, pepper and sugar and the use of less salt and tamarind. However, in both the cases, were also those who recommended the reverse, though fewer in number. For all preparations there was enough disagreement within each sample and across samples to conclude that a standardized recipe cannot satisfy all respondents. It is reassuring, however, that the majority of the respondents found the RDF recipes for *kaeng liang* and *nam prik* just right.

4.2 Revealed Acceptability (Leftovers)

The physical acceptability described above was based on the expressed preference statements of the respondents. Revealed acceptability on the other hand, is based on the preference implied by the leftovers, that is the portion of the serving of each preparation which was not eaten by the respondent. The absolute index of revealed acceptability was based on formula (3.6) and (3.7) and the relative index on formula (3.8). Both indexes are reported in Table 5.

The first point to notice in Table 5 is that the Kasetsart sample appears to have a stronger preference for both the traditional (0.857) and the RDF dishes (0.676) than the Jute Mill sample with (~~0.803~~ 0.749) and (~~0.642~~ 0.607) respectively.* In relative terms, however, the RDF dishes at the Jute Mill (0.810) fared better against the traditional

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*This difference must have been at least partly due to the fact that the meals at Kasetsart were served at the regular lunch time (12-1pm.) while at the Jute Mill they were served earlier in the day (10.30-11.30) when the respondents were presumably less hungry.

Table 5. Revealed Acceptability of Roller-Dried Fish Based on Leftovers

Acceptability index	Kasetsart University					Jute Mill					Combined average total
	Kaeng som	*Kaeng luang*	*Nam prik*	*Kaeng liang*	Total average	*Kaeng som*	*Kaeng luang*	*Nam prik*	*Kaeng liang*	Total average	
Absolute index of TRD	.855	.881	.874	.818	.857	.781	.777	.640	.795	.749	.803
-rank	3	1	2	4	-	6	7	8	5	-	-
Absolute index of RDF	.673	.684	.558	.760	.676	.685	.651	.460	.631	.607	.642
-rank	4	3	7	1	-	2	5	8	6	-	-
Relative index of RDF	.787	.776	.673	.929	.789	.877	.838	.710	.794	.810	.800
-rank	5	6	8	1	-	2	3	7	4	-	-
	All in percentages of the sample (except for the rank)										
Leftovers											
1. RDF < TRD	7.7	8.9	3.7	1[illegible].1	9.6	8.4	7.0	6.2	4.5	6.5	8.1
2. RDF = TRD	35.1	30.5	23.8	42.6	33.0	51.7	33.1	41.0	32.0	39.5	36.3
3. RDF > TRD	54.3	60.0	72.4	34.3	55.3	39.9	59.9	52.8	55.1	51.9	53.6
4. Unrecorded	2.9	0.5	0.0	5.1	2.1	0.0	0.0	0.0	8.3	2.1	2.1
Rank of RDF (1 & 2)	5	6	8	1	-	2	4	3	7	-	-

TRD: Traditional (preparation)
RDF: Roller-Dried Fish
Source: Records of 'Leftovers' from RDF tests. Top part computed according to formulas (3.6) and (3.7)

4.3 Economic Acceptability and Price Responsiveness

Up to this point we studied the acceptability of RDF preparations both in their own right and in comparison to their traditional counterparts but without any reference to relative costs. Moreover, since the various preparations were served to the respondents free of charge, there was no opportunity to observed their preferences as revealed in their economic decisions (purchases). To fill this gap we asked the respondents to state their preferences between traditional and RDF preparations at different sets of relative prices. In this way, the index of economic acceptability described in formula (3.4) was constructed and the results recorded in Table 6.

When the respondents were asked to choose between the RDF and the traditional preparations, given equal prices, the great majority, as expected, chose the traditional preparations. RDF dishes were chosen by less than one-third of the respondents while an even smaller percentage was indifferent between the two or uncertain. However, there was a marked difference in popularity between the various RDF preparations. *Kaeng som* at the Jute Mill was the most popular RDF dish as 29.4 percent of the sample chose it over the traditional even at the same price; *kaeng liang* at Kasetsart came a close second with 27.8 percent of the sample. *Nam prik* at Kasetsart had the lowest rating (7.0 percent of the sample) in terms of economic acceptability (E). It is felt, however, that E (RDF preference + indifference) would be a better index of economic acceptability as the new product has the disadvantage of being new and unaccustomed to.

When indifference between RDF and the traditional dish is added to RDF preference to obtain E (according to formula 3.4) *kaeng liang* at Kasetsart reemerged as the most popular RDF dish with 44.5 of the sample followed by *kaeng som* at the Jute Mill with 37.1 percent. Third, in order was *nam prik* at the Jute Mill with 35.5 percent and fourth *kaeng liang*, also at the Jute Mill, with 32.7 percent. *Nam prik* and *kaeng luang* at Kasetsart were the least popular dishes with

Preference at price	Kasetsart University					Jute Mill					Combined average total
	Kaeng som	*Kaeng luang*	*Nam prik*	*Kaeng liang*	Total average	*Kaeng som*	*Kaeng luang*	*Nam prik*	*Kaeng liang*	Total average	
A. $P_{RDF} = P_{TRD}$											
1. TRD	74.5	75.6	83.6	55.1	72.1	60.1	73.2	63.4	66.7	65.9	69.0
2. RDF	15.9	13.1	7.0	27.8	16.0	29.4	12.1	17.5	7.7	16.7	16.3
3. Either	9.6	10.3	8.9	16.7	11.4	7.7	14.0	18.0	25.0	16.2	13.8
4. Uncertain*	0.0	1.0	0.5	0.5	0.5	2.8	0.6	1.2	0.6	1.3	0.9
Rank of RDF (2 & 3)	5	7	8	1	-	2	6	3	4	-	-
B. $P_{RDF} = .75P_{TRD}$											
1. TRD	63.5	64.8	73.4	46.3	62.0	51.7	66.9	50.3	61.5	57.6	59.8
2. RDF	28.8	29.6	22.0	49.5	32.5	37.1	22.3	29.2	18.0	26.7	29.6
3. Either	7.2	5.2	4.7	4.2	5.3	6.3	10.2	17.4	18.6	13.1	9.2
4. Uncertain*	0.0	0.5	0.0	0.0	0.1	4.9	0.7	3.1	1.9	2.7	1.4
Rank of RDF (2 & 3)	5	6	8	1	-	3	7	2	4	-	-
C. $P_{RDF} = .5P_{TRD}$											
1. TRD	46.6	53.5	53.3	32.4	46.5	39.1	57.3	39.8	45.5	45.4	46.0
2. RDF	49.0	41.8	42.0	63.9	49.2	43.3	28.7	39.1	25.6	34.2	41.7
3. Either	2.4	3.3	4.7	3.2	3.4	11.2	10.8	16.1	23.7	15.5	9.5
4. Uncertain*	1.9	1.4	0.0	0.5	0.9	5.6	3.2	4.3	5.1	4.6	2.8
Rank of RDF (2 & 3)	4	7	6	1	-	3	8	2	5	-	-
D Total average											
RDF (2 & 3)	37.6	34.4	29.1	55.1	38.8	45.0	32.7	45.8	40.67	41.0	39.9
Rank	5	6	8	1	-	3	7	2	4	-	-

* Includes those who said they were 'not sure' as well as those who gave no answer.

P: Price TRD: Traditional (preparation)

RDF: Roller-Dried Fish

Source: Computed according to formula (3.4) from figures given in Appendix E (Table E1)

dishes than at Kasetsart (0.789).

Among the RDF dishes, *kaeng liang* was both in absolute (0.760) and relative (0.929) terms the most acceptable preparation to the Kasetsart sample while *kaeng som* was found most palatable at the Jute Mill with an absolute index of 0.685 and a relative index of 0.877. *Nam prik,* the second-best RDF preparation according to the respondent's expressed preferences (see indexes of physical acceptability in subsection 4.1.5) emerged as the least popular dish according to leftovers. This discrepancy, however striking at first glance, is not irreconcilable. *Nam prik,* a very spicy preparation, is basically a dip dish not easily consumable especially when considering that each respondent was given two servings, a traditional and one with RDF. This explanation is supported by the Jute Mill figures showing *nam prik* having the higher leftovers (lowest index, 0.640) even in its traditional form.* The figures for Kasetsart indicate a clear choice for *nam prik* in its traditional form (0.874); RDF *kaeng luang* (0.680) and RDF *kaeng som* (0.673) were far more preferable than RDF *nam prik* (0.558). Overall,** *kaeng liang* was the most acceptable preparation both in absolute (0.684) and in relative terms (0.848) followed by *kaeng som* with 0.649 and 0.793 respectively.

Table 5 further records the percentages of the sample who had less, equal, and more leftovers of the RDF than of the traditional preparations. A similar ranking was obtained except for a considerable improvement in the performance of *nam prik* at the Jute Mill.

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* Moreover, since *nam prik* with fish is of strong taste as well as spicy its acceptability might have suffered from the fact that it was served as an early lunch.

** 'Overall' refers to the combined results of the two samples; the numbers that follow in parentheses are averages of the individual sample indexes for the dish concerned (averages by preparation are not shown in the Tables for brevity; see footnote on page 35 for further details).

indexes of 15.9 percent and 23.4 percent respectively. Overall, *kaeng liang* was the most acceptable preparation followed by *kaeng som*; least acceptable was *kaeng luang*.

When the (hypothetical) price of RDF dishes was lowered to three-fourths of the price of the traditional dishes *kaeng liang* at Kasetsart became the first RDF dish to exceed its traditional counterpart in popularity, earning the preference of 50 percent of the sample with another 4 percent reporting indifference. In fact, the popularity of all RDF dishes increased with the rise in price, but there was little change in their relative position. The second and third positions were still held by *kaeng som* and *nam prik* at the Jute Mill (respectively if the indifferent percentage is ignored and in reverse order if indifference is counted). *Nam prik* at Kasetsart remained at the bottom although its popularity increased somewhat. The overall ranking was as follows: *kaeng liang, kaeng som, nam prik* and *kaeng luang* (see Part B of Table 6)

When the price of the RDF dishes was lowered even further to only half the price of the traditional dishes as many as 64 percent of the Kasetsart respondents chose RDF *kaeng liang* over the traditional preparation, almost 50 percent chose RDF *kaeng som* and over 40 percent chose each of the other two RDF dishes. At the Jute Mill *kaeng som* and *nam prik* were respectively preferred by 43.3 percent and 39.1 percent of the sample while another 11.2 and 16.1 percent respectively reported indifference. The overall ranking obtained during the previous two sets of relative prices was preserved at this last price iteration, except for a marked improvement in the rating of *nam prik* among the Kasetsart respondents. Based on this last set of relative prices ($P_{RDF} = 0.5\ P_{traditional}$) the site-specific and overall rankings of the RDF dishes hade as follows:

KASETSART

Dish	E'
1. *Kaeng liang*	67.1
2. *Kaeng som*	51.4
3. *Nam prik*	46.7
4. *Kaeng luang*	45.1

JUTE MILL

Dish	E'
1. *Nam prik*	55.2
2. *Kaeng som*	54.5
3. *Kaeng liang*	49.3
4. *Kaeng luang*	39.5

OVERALL SAMPLE

Dish	E'
1. *Kaeng liang*	58.2
2. *Kaeng som*	53.0
3. *Nam prik*	51.0
4. *Kaeng luang*	42.3

Where E' is the (modified) index of economic acceptability (see formula 3.4 in section 3.2 for details).

Thus, the ranking according to economic acceptability is very similar to the ranking according to the physical acceptability except that in economic terms *kaeng som* fared better than *nam prik*

The high price responsiveness of the sample is worth noting: the acceptability index of every RDF dish rose and of every traditional dish fell with the lowering of the price of the RDF dishes. However, the degree of price responsiveness varied among dishes, samples and price levels. As explained in Chapter 3,we measure price responsiveness by the price, elasticity of acceptability calculated according to formula (3.6) and reported in Table 7. It is evident from this Table that the Kasetsart University low-rank staff were more price-responsive than the Jute Mill workers. At a price of 4 baht per RDF dish a price reduction of 10 percent increased the overall acceptability of the RDF dishes by 15.2 at Kasetsart compared tc 0.84 percent at the Jute Mill.

At price of 3 baht a further reduction by 10 percent increased the acceptability by 11.7 percent at Kasetsart and by 0.75 at the Jute Mill. That is, the acceptability of RDF at Kasetsart is fairly elastic ($\varepsilon > 1.00$). Overall, however, the elasticity of acceptability is approximately equal to one implying that a 10 percent reduction in the price of the RDF dishes below the price of the traditional dishes would increase the acceptability of (and perhaps the demand for) RDF by about 10 percent.

Another important point to notice in Table 7 is that the elasticities are, in general, lower at the reduced price. A further reduction in the price of RDF dishes had less effect on their acceptability than the first reduction as one would expect (although this is not without exceptions). In fact, the overall elasticity turns from slightly elastic (1.16) to slightly inelastic (0.96)

Elasticities vary not only between samples and price levels, they also vary among dishes. *Nam prik* at the initial price level ($P_{RDF} = P_{TRD} = 4$) was the most price-elastic dish of each sample: at Kasetsart its elasticity was 2.72 while at the Jute Mill it was the only dish with price elastic acceptability. At the reduced price (3 baht) *nam prik* at Kasetsart continued to have a larger than 2.00 elasticity, though reduced somewhat, while at the Jute Mill it was most inelastic ($\varepsilon = 0.55$). *Kaeng luang* was another dish whose elasticity fell drastically after the first price reduction: at Kasetsart it fell from 1.95 at the initial price level to 0.69 at the reduced price level, and at the Jute Mill it fell from almost one to 0.65. This implies that while much was gained in terms of acceptability by the first price reduction, the response to the second reduction was minimal. In the case of *kaeng luang* at the Jute Mill a 10 percent reduction in price brought about 6.5 percent increase in acceptability.

The elasticities for *kaeng liang* and *kaeng som*, the 'economically' most acceptable RDF preparations, behaved differently at Kasetsart, where they were high, 0.83 and 1.65 respectively, to start

Table 7. Price Elasticity of Acceptability of the Roller-Dried Fish

Sample/Preparation	At P=4฿; and ΔP = 25%		At P=3฿; and ΔP = 33%	
	Elasticity	Rank	Elasticity	Rank
Kasetsart University				
Kaeng som	1.65	3	1.28	2
Kaeng luang	1.95	2	0.69	6
Nam prik	2.72	1	2.25	1
Kaeng liang	0.83	6	0.75	5
Total average	1.52	-	1.17	-
Jute Mill				
Kaeng som	0.68	7	0.77	4
Kaeng luang	0.98	5	0.65	7
Nam prik	1.25	4	0.55	8
Kaeng liang	0.48	8	1.04	3
Total average	0.84	-	0.75	-
Combined total average	1.16	-	0.96	-

P : Price

ΔP: Price change

฿ : Baht, the Thai currency; US$1 = 20 baht (approximately)

Source: Computed according to formula (3.5) from the figures given in Table 6.

with, they fell only slightly, down to 0.75 and 1.28 respectively; at the Jute Mill, where they were low, 0.48 for *kaeng liang* and 0.68 for *kaeng som,* to start with, they rose up to ~~0.77~~ 1.04 and ~~1.04~~ 0.77 respectively. Particularly striking is the transformation of *kaeng liang* at the Jute Mill from the most inelastic dish to the most elastic one in switching positions with *nam prik* initially the most elastic RDF preparation. In conclusion, *kaeng som* and *nam prik* at Kasetsart and *kaeng som* and *kaeng liang* at the Jute Mill could be made more popular by a further reduction in costs.

CHAPTER 5

ACCEPTABILITY OF FISH PROTEIN CONCENTRATE-TYPE B

5.1 Physical Acceptability

Having described in detail the application of the analytical framework (developed in chapter 3) to the case of Roller-Dried Fish we can be more concise in reporting the results of the Fish Protein Concentrate Tests. It is assumed that the reader has already familiarize himself with the material presented in chapters 3 and 4.

The local names of the four dishes selected for testing FPC were *kaeng kua, nam prik, kaeng som* and *kaeng kare*; their recipes appear in Appendix A. The indexes of both the absolute and the relative acceptability of the FPC dishes are reported in Table 8. (For a detailed explanation and application of these concepts see chapters 3 and 4 respectively). The results are presented by sample site, product and dish type and by physical aspect.

5.1.1 Colour

Except for *kaeng kare* which performed poorly in both locations (0.633 average), all other traditional dishes were found highly acceptable with the absolute acceptability index ranging between 0.829 and 0.911. *Kaeng kua* at the Jute Mill (0.911) was the most popular traditional dish with respect to colour (and all other aspects as we will be seeing in the sequel). Among the FPC dishes *kaeng kare* at the Jute Mill (0.679) was indisputably the most preferable dish followed by *kaeng kua* (0.646). At Kasetsart also *kaeng kare* (0.604) was the first choice followed by *kaeng kua* (0.577). As a result these two dishes came first and second, respectively, in the overall ranking of colour preferences (see part A of Table 8).

Exactly the same order was obtained though the relative acceptability index. The colour of *kaeng kare* with FPC served at the Jute Mill (1.051) was, in fact, preferable to that of the traditional version, reflecting partly the popularity of the former and the unpopularity of the latter. The sample at Kasetsart also rated the colour

Table 8. Physical Acceptability of Fish Protein Concentrate - Type B.

Acceptability index	Kasetsart University					Jute Mill					Combined total average
	Kaeng kua	*Nam prik*	*Kaeng som*	*Kaeng kare*	Total average	*Kaeng kua*	*Nam prik*	*Kaeng som*	*Kaeng kare*	Total average	
A. Colour											
Absolute index of TRD	.829	.836	.833	.623	.780	.911	.872	.883	.642	.827	.804
- rank	6	4	5	8	-	1	2	3	7	-	-
Absolute index of FPC	.577	.544	.531	.604	.564	.646	.525	.558	.679	.602	.583
- rank	4	6	7	3	-	2	8	5	1	-	-
Relative index of FPC	.696	.651	.637	.970	.723	.709	.602	.632	1.051	.730	.725
- rank	4	5	6	2	-	3	8	7	1	-	-
B. Consistency											
Absolute index of TRD	.819	.800	.830	.778	.807	.849	.824	.836	.685	.799	.803
- rank	5	6	3	7	-	1	4	2	8	-	-
Absolute index of FPC	.609	.589	.558	.604	.590	.571	.611	.581	.682	.611	.601
- rank	3	5	8	4	-	7	2	6	1	-	-
Relative index of FPC	.770	.736	.672	.776	.731	.673	.742	.695	.996	.765	.748
- rank	3	5	8	2	-	7	4	6	1	-	-
C. Taste											
Absolute index of TRD	.801	.828	.814	.772	.804	.873	.867	.853	.601	.799	.802
- rank	6	4	5	7	-	1	2	3	8	-	-
Absolute index of FPC	.521	.539	.514	.551	.531	.601	.539	.527	.646	.578	.555
- rank	6	4	7	3	-	2	4	5	1	-	-
Relative index of FPC	.650	.651	.631	.714	.661	.688	.622	.618	1.075	.723	.692
- rank	5	4	6	2	-	3	7	8	1	-	-

Table 8. (continued)

Acceptability index	Kasetsart University					Jute Mill					Combined total average
	Kaeng kua	*Nam prik*	*Kaeng som*	*Kaeng kare*	Total average	*Kaeng kua*	*Nam prik*	*Kaeng som*	*Kaeng kare*	Total average	
D. <u>Smell</u>											
Absolute index of TRD	.786	.811	.819	.758	.794	.843	.824	.801	.623	.773	.784
- rank	6	4	3	7	-	1	2	5	8	-	-
Absolute index of FPC	.546	.536	.514	.546	.536	.618	.563	.541	.647	.592	.564
- rank	4	5	6	4	-	2	3	5	1	-	-
Relative index of FPC	.695	.661	.628	.720	.674	.733	.683	.675	1.039	.766	.719
- rank	4	7	8	3	-	2	5	6	1	-	-
E. <u>Total average</u>											
Absolute index of TRD	.809	.819	.824	.733	.796	.863	.847	.843	.639	.793	.795
- rank	6	5	4	7	-	1	2	3	8	-	-
Absolute index of FPC	.563	.552	.529	.576	.555	.603	.560	.552	.664	.595	.575
- rank	4	5	7	3	-	2	6	5	1	-	-
Relative index of FPC	.696	.674	.642	.786	.697	.699	.661	.655	1.039	.750	.723
- rank	4	5	8	2	-	3	7	6	1	-	-

TRD : Traditional (preparation)
FPC : Fish Protein Concentrate
Source : Computed according to formulas (3.2) and (3.3) from figures given in Appendix E.(Table E.2)

of the FPC dish highly (0.970) though still a bit below the traditional dish. In general, with respect to colour as well as with respect to other aspects FPC dishes scored better at the Jute Mill than at Kasetsart (see part A of Table 8) which is exactly the reverse of what happened with RDF (see part A of Table 4).

5.1.2 Consistency

This aspect is of particular importance to FPC because of its rather unusual texture which might be a disadvantage in certain preparations. As seen from part B of Table 8, the traditional *kaeng kua* (0.849) and the FPC *kaeng kare* (0.682), both at the Jute Mill, remained at the top. At Kasetsart,however,the top dishes were *kaeng som* (0.830) among the traditional and *kaeng kua* (0.609) among the new. Second among the latter were *nam prik* at the Jute Mill and *kaeng kua* at Kasetsart. Least acceptable among the FPC dishes in terms of consistency was *kaeng som* at both locations (0.570 average). Overall, *kaeng kare* and *nam prik* had the most palatable consistency in that order.

In relative terms, the Jute-Mill respondents found the consistency of *kaeng kare* with FPC equally acceptable with that of the traditional version (R index = 0.996). At Kasetsart the same dish served only 0.776, followed by *kaeng kua* with 0.770. At the Jute Mill *nam prik* was second with 4.742. Overall*, *kaeng kare* (0.886) was first, *nam prik* (0.739) second *kaeng kua* (0.722) third, and *kaeng som* (0.684) last.

5.1.3 Taste

In terms of taste, the most important aspect of any food preparation, the top choices among the FPC dishes were *kaeng kare* (0.646) and *kaeng kua* (0.601) at the Jute Mill, and *kaeng kare* (0.551)

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*The term 'overall' throughout the chapter refers to the combined results of the two samples; the numbers which follow in parentheses are the averages of the two sample indexes for the preparation concerned; they are not given in the Tables for reasons of brevity but are easily obtainable through simple averaging of the two individual sample indexes, for each preparation.

and *nam prik* (0.539) at Kasetsart. *Nam prik* was third at the Jute Mill although it had exactly the same index of absolute acceptability as it did at Kasetsart (see part C of Table 8). *Kaeng som* was the least acceptable dish at both places. The overall ranking was as follows *kaeng kare* (0.599), *kaeng kua* (0.561), *nam prik* (0.539) and *kaeng som* (0.521). The same ordering was obtained through the relative index. It is remarkable, that the Jute Mill respondents have voted *kaeng kare* with FPC (1.075) preferable to the traditional dish. *Kaeng kare* at Kasetsart (0.714) came a distant second while the rest were considered only slightly more than 'half as tasty' (R = 0.618 to 0.688) as their traditional counterparts. Overall, however, *kaeng kua* has consolidated its position as the second most preferable dish above *nam prik*. It became also evident that FPC dishes were, in general, liked at the Jute Mill than at Kasetsart.

5.1.4 Smell

As it can be easily attested by glancing at the part D of Table 8, smell did not alter the overall ordering of FPC dishes obtained earlier. *Kaeng kare* and *kaeng kua* continued to be the most acceptable FPC dishes both in absolute order of preference and in comparison to the traditional versions. In addition to colour and taste, the smell of *kaeng kare* with FPC was rated by the Jute Mill respondents above the smell of the same dish with fresh fish.

5.1.5 All Aspects Combined

When all aspects—colour, consistency, taste and smell--are combined into one index of total physical acceptability (see part E of Table 8) the following ranking is obtained (recall that A and R are respectively the absolute and relative indexes of physical acceptability).

KASETSART

Dish	A	R
1. *Kaeng kare*	0.576	0.786
2. *Kaeng kua*	0.563	0.696
3. *Nam prik*	0.552	0.674
4. *Kaeng som*	0.529	0.642

JUTE MILL

Dish	A	R
1. *Kaeng kare*	0.664	1.039
2. *Kaeng kua*	0.603	0.699
3. *Nam prik*	0.560	0.661
4. *Kaeng som*	0.552	0.655

OVERALL SAMPLE

Dish	A	R
1. *Kaeng kare*	0.620	0.913
2. *Kaeng kua*	0.583	0.698
3. *Nam prik*	0.556	0.667
4. *Kaeng som*	0.541	0.649

Thus, based on physical acceptability alone all four FPC dishes were acceptable (fair). The difference between the most and the least acceptable dishes was rather narrow; all dishes were liked between 'fair' and 'much' none below and none above, whereas all the traditional dishes, except for *kaeng kare*, were liked between 'much' and 'very much'. The Jute Mill sample rated all FPC dishes higher than the Kasetsart sample. In relative terms, the Jute-Mill sample liked *kaeng kare* with FPC more than *kaeng kare* with fresh fish. This particular recipe faired relatively well at Kasetsart too, while all the rest had less than 70 percent of the popularity of the corresponding traditional dishes.

Of all the aspects of FPC--colour, consistency, taste and smell--taste (0.555) was the least satisfactory aspect of FPC especially when compared to the traditional taste (0.803). The smell of RDF was also rated low (0.564). It is remarkable that consistency, often considered the FPC's weakest point, obtained the highest overall rating both in absolute (0.601) and in relative (0.748) terms, suggesting the need to improve more the taste than the texture of FPC. Improvement in the recipes is also possible. For instance, there was more or less agreement among respondents that less salt would improve the taste of all FPC recipes. There was also some concensus that use of more sugar, less salt and less tamarind could improve the taste of *kaeng kua*. On the other hand, there were also conflicting suggestions. For instance, in the case of *nam prik* the Kasetsart respondents recommended the use of more fish, tamarind, chili paste and sugar and of less salt, while the Jute Mill respondents called for the use of less fish, more pepper as well as more tamarind and less salt. In the case of *kaeng kare* the Kasetsart sample asked for more fish, tamarind, pepper, and

sugar and for less salt at the Jute Mill, it was proposed that more fish and pepper and less salt as the only necessary changes in the recipe.

5.2 Revealed Acceptability

As explained earlier the physical index of acceptability of colour, consistency, taste and smell is based on the expressed preference of the respondents. In contrast, revealed acceptability is based on the preference implied by the amount of leftovers, which has, on the one hand, the advantage of being based on 'actions rather than words', and the disadvantage of not distinguishing between hunger and preference, on the other. Furthermore, it treats all dishes in the same way which puts those that are not meant to be consumed to the last drop (e.g. *nam prik* and *kaeng kua*) in a disadvantageous position. Nevertheless, it is a useful indicator, especially in its relative form, as a cross- check of large differences in stated preference among preparations. The revealed acceptability was calculated according to formulas (3.6), (3.7) and (3.8) and the results are reported in Table 9.

There appear to be some significant differences in ranking of dishes between the revealed acceptability and the indexes discussed earlier. First, there has been a reversal in overall preference between the two samples. According to the expressed physical acceptability indexes the Jute Mill sample had a stronger preference for the FPC dishes than the sample from Kasetsart the smaller amounts of leftovers at the latter indicate the reverse. As in the case of RDF, two reasons may account for the larger amount of leftovers at the Jute Mill: (i) 95.6 of the respondents were women compared to only 67.7 percent at Kasetsart, and (ii) the test at the Jute Mill took place at 10 AM compared to 12 noon at Kasetsart.* This reasoning is substantiated by the fact that the leftovers of the traditional preparations were also larger at the Jute Mill.

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*While 10 AM was the regular lunch break of the shift at the Jute Mill, a number of respondents had breakfast only a couple of hours earlier.

Table 9. Revealed Acceptability of Fish Protein Concentrate - Type B Based on Leftovers.

Acceptability Index	Kasetsart University					Jute Mill					Combined total average
	Kaeng kua	*Nam prik*	*Kaeng som*	*Kaeng kare*	Total average	*Kaeng kua*	*Nam prik*	*Kaeng som*	*Kaeng kare*	Total average	
Absolute index of TRD	.803	.902	.838	.831	.846	.856	.715	.890	.553	.754	.800
- rank	6	1	5	4	-	3	7	2	8	-	-
Absolute index of FPC	.399	.600	.580	.597	.544	.480	.253	.567	.612	.478	.511
- rank	7	4	3	2	-	6	8	5	1	-	-
Relative index of FPC	.497	.665	.692	.718	.643	.561	.354	.637	1.107	.634	639
- rank	7	4	3	2	-	6	8	5	1		
Leftovers											
1. FPC < TRD	3.3	2.5	6.5	9.7	5.5	4.6	2.0	2.7	39.1	12.1	8.8
2. FPC = TRD	15.2	29.4	19.5	26.7	22.7	23.2	20.3	28.1	36.4	37.0	24.9
3. FRC > TRD	76.8	66.2	71.5	62.6	69.3	72.2	77.7	69.2	24.5	60.9	65.1
4. Unrecorded	4.7	2.0	2.5	1.0	2.6	0.0	0.0	0.0	0.0	0.0	1.3
Rank of FPC (1&2)	8	3	6	2	-	5	7	4	1	-	-

TRD : Traditional (preparation)
FPC : Fish Protein Concentrate
Source : Records of 'Leftovers' from RDF tests. Top part computed according to formulas (3.6) and (3.7).

Of the four FPC preparations *kaeng kare* was found to be most palatable among the Jute Mill respondents (0.612) followed by *kaeng som* (0.567). At Kasetsart *nam prik* (0.600) followed by *kaeng kare* (0.597) were at the top. Overall, however, *nam prik* was the least acceptable dish because of a very poor performance at the Jute Mill (0.253), which may have been due to the 'unsuitability' of this dish for a 10 AM lunch.**

Kaeng kua, which was earlier rated second in terms of colour, consistency, taste, and smell, emerged now as totally unacceptable in terms of leftovers at both locations (0.440 agerage), while *kaeng som*, the least acceptable dish otherwise, was now second in terms of revealed acceptability. Again, this is a reflection of the different nature of the two dishes. *Kaeng som* is a 'light' preparation more like a soup. *Kaeng kua* on the other hand, is a 'thick' preparation with a lot of coconut milk which makes it a very filling dish (see recipes in Appendix A). At Kasetsart, as shown in Table 9, *kaeng kua*, even in its traditional form, had more leftovers than any other preparation; in the Jute Mill it performed better, partly because the traditional *kaeng kare* and *nam prik* were not very popular.

Overall, *kaeng kare* with FPC at the Jute Mill (1.108) was found to be preferable to its traditional version, which confirms the results obtained based on (expressed) physical acceptability. At Kasetsart too the performance of *kaeng kare* (0.709) has confirmed earlier results. The rest were ranked by the relative index of revealed acceptability as follows: *kaeng som* (0.692), *kaeng kua* (0.528) and *nam prik* (0.509).

5.3.1 Economic Acceptability and Price Responsiveness

Thus far, the economic factor was ignored. Dishes were rated according to the consumers' stated or revealed preferences with regard to their physical properties. A major advantage of FPC, however, lies in its relative inexpensiveness which low-income groups

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** As mentioned earlier *nam prik* is of a very strong taste and smell.

may find appealing. Based on the sample's response to hypothetical sets of relative prices, the index of economic acceptability was computed according to formula (3.4) and reported in Table 10.

At an equal price of 4 baht per dish, the traditional dishes were overwhelningly prefered with the nocable exception of *kaeng kare* with FPC which was prefered over the traditional version by 42 percent of the Jute-Mill sample while another 23 percent expressed indifference between the two. Less than 30 percent had a preference for the traditional *kaeng kare*. This is in total agreement with results obtained earlier according to physical and revealed acceptability. *Kaeng kare* also ranked first among the FPC dishes at Kasetsart: while 78 percent of the respondents expressed preference for the traditional dish there still was some 22 percent who felt that the FPC preparation was better or at least not worse than the fresh-fish preparation which is significant considering that the FPC dish was over-priced at the cost of the traditional dish. Another FPC dish which performed well at the price of 4 baht was *kaeng kua* : about 32 percent of the Jute-Mill sample rated the FPC preparation as better than or equal to the traditional dish. There was clearly a stronger preference for the FPC dish at the Jute Mill (25.5 percent on the average) than at Kasetsart (16.5 percent). Overall, the same ranking was obtained as with the index of physical acceptability i.e. (1) *kaeng kare*, (2) *kaeng kua*, (3) *nam prik*, and (4) *kaeng som*.

Next, the price of the FPC preparations was reduced to three baht per dish, or 75 percent of the price of the traditional preparations which was retained at 4 baht per dish. The most 'dramatic' change, as a result, was the increase in the popularity of *kaeng kua* at Kasetsart from the previous 15.6 to 24.7. *Nam prik* at Kasetsart and *kaeng som* at both locations also became more acceptable. In general, however, the popularity of the traditional preparations did not decline much; there was, instead, an across-the-board shift in favor of FPC by many of those who previously expressed indifference. The already high popularity of *kaeng kare* at the Jute Mill rose only slightly, to 66 percent of the sample. While *kaeng kare* at Kasetsart

Table 10. Economic Acceptability of Fish Protein Concentrate - Type B.

Preference at price	Kasetsart University					Jute Mill					Combined total average
	Kaeng kua	*Nam prik*	*Kaeng som*	*Kaeng kare*	Total average	*Kaeng kua*	*Nam prik*	*Kaeng som*	*Kaeng kare*	Total average	
A. $P_{FPC} = P_{TRD}$											
1. TRD	83.9	85.3	84.0	77.9	82.7	66.9	74.3	81.5	29.8	63.1	72.9
2. FPC	8.5	6.4	5.5	10.8	7.8	12.6	5.4	2.1	41.7	15.5	11.7
3. Either *	7.1	8.3	8.5	10.8	8.7	19.2	18.9	14.4	23.2	18.9	13.8
4. Uncertain	0.5	0.0	2.0	0.5	0.8	1.3	1.4	2.1	5.3	2.5	1.7
Rank of RDF (2&3)	6	7	8	4	-	2	3	5	1	-	-
B. $P_{FPC} = 0.75\ P_{TRD}$											
1. TRD	74.9	77.0	78.5	71.3	75.4	63.6	72.3	74.0	29.1	59.8	67.6
2. FPC	22.3	19.6	17.0	26.7	21.4	23.8	16.2	14.4	46.4	25.2	23.3
3. Either *	2.4	0.2	3.0	1.0	1.7	11.3	11.5	9.6	19.9	13.1	7.4
4. Uncertain	0.5	1.0	1.5	1.0	1.0	1.3	0.0	2.1	4.6	2.0	1.5
Rank of RDF (2&3)	4	8	7	3	-	2	3	5	1	-	-
C. $P_{FPC} = 0.50\ P_{TRD}$											
1. TRD	55.0	54.4	63.0	52.8	56.3	51.0	60.1	61.0	21.2	48.2	52.3
2. FPC	39.3	39.7	33.5	42.6	38.8	31.1	25.0	21.9	51.0	32.2	35.5
3. Either *	3.8	3.4	1.5	2.6	2.8	13.9	11.5	12.3	21.9	14.9	8.9
4. Uncertain	1.9	2.5	2.0	2.1	2.1	4.0	3.4	5.8	6.0	4.8	3.4
Rank of RDF (2&3)	4	4	6	2	-	3	5	7	1	-	-
D. Total Average											
RDF (2&3)	27.8	25.9	23.0	31.5	27.1	37.3	29.5	24.9	68.0	39.9	33.5
Rank	5	6	8	3	-	2	4	7	1	-	-

* Includes those who said they were 'not sure' as well as those who gave no answer

P : Price; TRD : Traditional (preparation); FPC : Fish Protein Concentrate.

Source : Computed according to formula (3.4) from figure given in Appendix E (Table E.2)

made more significant gains, its popularity still remains below 30 percent of the sample. The overall ranking remains unchanged with *kaeng kua* consolidating its second position after *kaeng kare*.

At the third and last iteration, the price of FPC dishes was set at 2 baht per dish or 50 percent of the price of the traditional dishes. Significant improvements in acceptability took place across the board; yet, no FPC dish, except for *kaeng kare* at the Jute Mill exceeded its traditional counterpart in popularity although several came fairly close. In the case of *kaeng kare* only 21 percent of the Jute-Mill sample continued to prefer the traditional dish; 51 percent choose FPC, 22 percent were indifferent between the two, and 6 percent were uncertain. Over 45 percent of the Kasetsart sample rated FPC *kaeng kare* better than or at least as good as the traditional dish. About the same percentage of the Jute-Mill sample rated *kaeng kua* with FPC at the same position. Also, *kaeng kua* and *nam prik* with FPC were rated at least as good as their traditional versions by over 33 percent of the respondents at Kasetsart. *Nam prik*, while far ahead of *kaeng som* in popularity at Kasetsart, was almost as unpopular as *kaeng som* at the Jute Mill. Based on this last set of relative prices ($P_{FPC} = 0.5\ P_{traditional}$), the site-specific and overall rankings were as follow:

KASETSART

Dish	E'
1. *kaeng kare*	45.2
2. *kaeng kua*	43.1
3. *nam prik*	43.1
4. *kaeng som*	35.0

JUTE MILL

Dish	E'
1. *kaeng kare*	72.2
2. *kaeng kua*	45.0
3. *nam prik*	36.5
4. *kaeng som*	34.2

OVERALL SAMPLE

Dish	E'
1. *kaeng kare*	58.7
2. *kaeng kua*	44.1
3. *nam prik*	39.8
4. *kaeng som*	34.6

where E' is the index of economic acceptability combining both strong and weak* preference for FPC dishes (see formula 3.4).

Thus, the ranking of FPC preparations according to economic acceptability was completely identical to the ranking according to physical acceptability obtained in sub-section 5.1.5.

The high price responsiveness observed for RDF dishes was also observed in the case of FPC dishes. The acceptability index of every FPC dish rose and of every traditional dish fell with the lowering of the price of the former while holding the price of the latter fixed at 4 baht per dish. However, unlike the case of RDF where the tendency was for the price elasticity of acceptability to fall after the first price reduction, in the case of FPC the tendency was for the elasticity to rise (see Table 11).

At price of 4 baht per dish, the FPC *kaeng kare* had the (highest) price elasticity of 2.33 meaning that a 10 percent reduction in price would increase the acceptability of the dish by 23.3 percent. *Kaeng som* at the two locations was the next most elastic preparation followed by *nam prik* at Kasetsart. *Kaeng kare* being the most popular dish is, as one might expect, the least elastic preparation at each sample site : at the Jute Mill it is almost completely inelastic ($\varepsilon = 0.09$) while at Kasetsart it is somewhat elastic ($\varepsilon = 1.12$) though considerably less than the other three preparations, (see Table 11).

Overall, the Kasetsart sample is considerably more elastic (sensitive to price changes) than the sample at the Jute Mill, which averaged a price elasticity of 0.45 implying that a 10 percent reduction in price would bring about only a 4.5 percent increase in the number of consumers of FPC dishes, compared to a 16 percent increase at Kasetsart. Only part of this difference can be explained by the fact the FPC dishes were, in general, more popular to start with, which meant that in percentage terms their popularity could not have increased much with the price reduction.

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* Weak preference for FPC is said to exist when the respondent is indifferent between an FPC and a traditional dish.

Table 11. Price Elasticity of the Acceptability of Fish Protein Concentrate-Type B.

Sample/Preparation	At P=4 ฿ and ΔP=25%		At P=3฿ and ΔP = 33%	
	Elasticity	Rank	Elasticity	Rank
Kasetsart University				
Kaeng kua	2.33	1	2.24	3
Nam prik	1.39	4	3.53	1
Kaeng som	1.71	3	2.25	2
Kaeng kare	1.12	5	1.90	4
Total average	1.60	-	2.40	-
Jute Mill				
Kaeng kua	0.42	7	0.85	7
Nam prik	0.56	6	0.95	6
Kaeng som	1.82	2	1.27	5
Kaeng kare	0.09	8	0.30	8
Total average	0.45	-	0.69	-
Combined total average	0.82	-	1.34	-

P = Price
ΔP = Price change
฿ = Baht, the Thai currency US$1=20 baht (approximatly).

Source : Computed according to formula (3.5) from the figures given in Table 10.

At a price of 3 baht per FPC dish, every preparation was more price elastic than at 4 baht per dish except for the already very elastic *kaeng kua* at Kasetsart and *kaeng som* at the Jute Mill whose elasticities declined somewhat but still remained considerably above 1.0 (see Table 11). The elasticity of *nam prik* at Kasetsart almost trippled, from 1.39 at 4 baht to 3.53 at 3 baht, while at the Jute Mill it almost doubled to slightly under 1.0. The price elasticity of *kaeng kare* at the Jute Mill also trippled but it was still the most inelastic preparation, having already attracted two-thirds of the respondents. At Kasetsart, however, there appeared to be considerable room for attracting more consumers to *kaeng kare* prepared with FPC through the reduction of price below 3 baht per dish. In fact, this was true of all preparations served at Kasetsart but only of *kaeng som* and possibly of *nam prik* at the Jute Mill. In conclusion, FPC dishes were, as expected, price inelastic at the Jute Mill, where they were liked most; and, fairly price elastic at Kasetsart, where price incentives appear to be very effective in increasing acceptability.

CHAPTER 6

COMPARISON BETWEEN ROLLER-DRIED FISH AND FISH PROTEIN CONCENTRATE

Having described and analyzed the results of testing of four recipes incorporating Roller-Dried Fish and four recipes incorporating Fish Protein Concentrate against their traditional counterparts, it would be useful to compare the two new products with each other. Three types of comparisons are possible: indirect comparison through juxtaposition of the information obtained thus far from the testing of recipes of each product against their traditional varsions; (ii) direct comparison by testing of RDF and FPC recipes against each other; and (iii) overall assessment by the consumers after the various tests for each of the two products.

6.1 Indirect Comparison

The reader must have formed by now some general impressions as to which of the two new fish products appears more acceptable. Table 12 presents a more systematic comparison of the various acceptability indexes calculated in Chapters 4 and 5 and presented in Table 4 to 11. Since the various preparations for RDF and FPC were chosen separately as to put each in its best possible use, the average acceptability of these preparations reflect the acceptability of the products themselves. Thus, by comparing the average performance of the two sets of preparations we obtain a measure of the relative acceptability of RDF and FPC Themselves. Moreover, two out of the four preparations for each product are based on the same traditional recipes (*kaeng som* and *nam prik*).

Based on Table 12 the following general observations may be made:

(i) Of the 18 indexes of acceptability presented in Table 12 (see total average) Roller-Dried Fish ranked above Fish Protein Concentrate in sixteen. The first exception was that the relative

Table 12 Indirect Comparison of Acceptability Between Roller-Dried Fish and Fish Protein Concentrate.

Index/Sample Site		Roller-Dried Fish					Fish Protein Concentrate				
		Kaeng som	*Kaeng luang*	*Nam prik*	*Kaeng liang*	Total average	*Kaeng kua*	*Nam prik*	*Kaeng som*	*Kaeng kare*	Total average
A. PHYSICAL ACCEPTABILITY											
1. Absolute Index											
Kasetsart	-index	.602	~~.612~~ .565	.602	.691	~~[illegible]~~ .615	.563	.552	.529	.576	.555
	-rank	2	4	2	1	A	5	6	7	3	B
Jute Mill	-index	.596	.545	.669	.615	.606	.603	.560	.552	.664	.595
	-rank	5	8	1	3	A	4	6	7	2	B
Combined	-index	.599	.573	.636	.653	.615	.583	.556	.541	.620	.575
	-rank	4	6	2	1	A	5	7	8	3	B
2. Relative index											
Kasetsart	-index	.762	.809	.780	.892	.810	.696	.674	.642	.786	.697
	-rank	5	2	4	1	A	6	7	8	3	B
Jute Mill	-index	.760	.672	.813	.735	.744	.699	.661	.655	1.039	.750
	-rank	3	6	2	4	B	5	7	8	1	A
Combined	-index	.761	.741	.797	.814	.775	.698	.668	.649	.913	.723
	-rank	4	5	3	2	A	6	7	8	1	B
B. REVEALED ACCEPTABILITY											
1. Absolute Index											
Kasetsart	-index	.673	.684	.558	.760	.676	.399	.600	.580	.597	.544
	-rank	3	2	7	1	A	8	4	6	5	B
Jute Mill	-index	.685	.651	.460	.631	.607	.480	.253	.567	.612	.478
	-rank	1	2	7	3	A	6	8	5	4	B
Combined	-index	.679	.668	.509	.696	.642	.436	.427	.574	.605	.511
	-rank	2	3	6	1	A	7	8	5	4	B

Table 12 (continued)

Index/Sample Site		Roller-Dried Fish					Fish Protein Concentrate				
		Kaeng som	*Kaeng luang*	*Nam prik*	*Kaeng liang*	Total average	*Kaeng kua*	*Nam prik*	*Kaeng som*	*Kaeng kare*	Total average
2. Relative Index											
Kasetsart	-index	.787	.776	.673	.929	.784	.496	.665	.692	.709	.643
	-rank	2	3	6	1	A	8	7	5	4	B
Jute Mill	-index	.877	.878	.710	.794	.810	.560	.354	.637	1.108	.634
	-rank	2	3	5	4	A	7	8	6	1	B
Combined	-index	.832	.807	.692	.862	.800	.528	.510	.665	.909	.639
	-rank	3	4	5	2	A	7	8	6	1	B
C. ECONOMIC ACCEPTABILITY											
1. Index (at $P_{NEW} = .5P_{TRD}$)											
Kasetsart	-index	51.4	45.1	46.7	67.1	52.6	43.1	43.1	35.0	45.2	41.6
	-rank	2	5	3	1	A	6	6	7	4	B
Jute Mill	-index	54.5	39.5	55.2	49.3	49.6	45.0	36.5	34.2	72.2	47.0
	-rank	3	6	2	4	A	5	7	8	1	B
Combined	-index	53.0	42.3	51.0	58.2	51.1	44.1	39.8	34.6	58.7	44.3
	-rank	2	5	3	2	A	4	6	7	1	B
2. Elasticity (at P_{NEW}=4baht)											
Kasetsart	- ε	1.65	1.95	2.72	0.83	1.52	2.33	1.39	1.71	1.12	1.60
	-rank	5	3	1	8	B	2	6	4	7	A
Jute Mill	- ε	0.68	0.98	1.25	0.48	0.84	0.42	0.56	1.82	0.09	0.45
	-rank	4	3	2	6	A	7	5	1	8	B
Combined	- ε	0.83	1.47	1.99	0.66	1.18	1.38	0.98	1.77	0.61	1.03
	-rank	6	3	1	7	A	4	5	2	8	B

index of physical acceptability at the Jute Mill was slightly higher for FPC (0.750) than for RDF (0.744) due to the excellent performance of *kaeng kare* with FPC. The second exception was that the elasticity of economic acceptability at Kasetsart was slightly higher for FPC (1.60) than RDF (1.52) because of the very low initial levels of acceptability at Kasetsart.

(ii) As a corollary of (i) above one may conclude that the physical properties of RDF preparations were found, on the average, more palatable and closer to the traditional product (fresh fish) than those of FPC. This indirect preference for RDF over FPC is substantiated by the fact that the leftovers from RDF preparations were fewer than those from FPC preparations, both in absolute amounts and in relation to the leftovers from the traditional dishes. In economic terms, more people chose RDF preparations over traditional dishes than did FPC preparations at the same set of relatives prices. Moreover, price reductions had a more pronounced (positive) effect on the acceptability of RDF than FPC preparations.

(iii) The overall differences in acceptability between RDF and FPC preparations were not, on the average, dramatic. The physical properties of RDF were only '7 percent' more preferable' than those of FPC, and fared only '7 percent closer' to the properties of the traditional dishes than did FPC. The differences in revealed acceptability were more pronounced: leftovers from RDF preparations were, on the average, less than leftovers from FPC preparations by 26 percent and closer to the amount of leftovers from the traditional dishes by 25 percent. The percentage of the overall sample that preferred the RDF preparations to the traditional dishes at $P_{RDF} = 0.5\ P_{traditional}$ was by 15 percent higher than the percentage of the sample that preferred the FPC preparations to the corresponding traditional dishes at $P_{FPC} = 0.5P_{traditional}$. Similarly, the economic acceptability of RDF preparations was by 15 percent more responsive to price changes (price elastic) than the acceptability of the FPC preparations. It is also worth noting that whereas most

traditional dishes were liked somewhere between 'much' and 'very much' every single new preparation, whether with FPC or RDF, was liked between 'fair' and 'much' (see absolute index of physical acceptability in Table 12 and recall that 0.500 = 'fair' and 0.750 - 'much').

(iv) There were significant differences in the acceptability of RDF and FPC between the two samples. RDF was rated higher by the Kasetsart sample than by the Jute-Mill sample in terms of both physical and economic acceptability.* FPC, on the other hand, was rated higher by the Jute Mill than by Kasetsart also in terms of both physical and economic acceptability. The differences which are fairly significant may arise from the different socio-economic background of the two samples (see Chapter 7 for further exploration of this relationship) and as such they may have important policy implications for subsequent phases of the project. In terms of specific preparations, the most popular dishes were *kaeng liang* at Kasetsart and *nam prik* at the Jute Mill. There was concensus, however, the two samples as to the most popular FPC dish, *kaeng kare* although the level of acceptability was substantially higher at the Jute Mill.

(v) Overall, the ranking of RDF dishes in order of acceptability was: 1. *kaeng liang* 2. *kaeng som* 3. *nam prik* and 4. *kaeng luang*. The ranking of FPC dishes, also in order of acceptability was: 1. *kaeng kare* 2. *kaeng kua* 3. *nam prik* and 4. *kaeng som* The first and the last positions in the two sets were more or

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* Use of the revealed acceptability (leftovers) for cross-sample comparisons is inappropriate because of (a) the difference in sex composition between the samples; (b) possible differences in the degree of hunger between the two samples arising from the difference in the time of the test; (c) difference in eating habits between different income groups (low-income groups in Thailand tend to eat more rice and less meat, fish and vegetables than higher-income groups).

less unchallenged, but there was occasional switching between the second and third positions in partial indexes (e.g. colour, consistency etc).

(vi) As mentioned earlier, two out of the four preparations for each fish product were common and hence they lend themselves to more direct comparisons. Table 12 shows both of these products, *kaeng som* and *nam prik*, to be faring better when prepared with RDF than with FPC with only one exception: the leftovers of *nam prik* with FPC at Kasetsart were considerably less (revealed acceptability index of 0.600) than the leftovers of *nam prik* with RDF (0.558).* All other indicators point to a preference for RDF at both locations. However, this is still an indirect comparison. As it is well known, the ranking of two items is not invariant to the presence of a third alternative: direct and indirect comparisons do not necessarily give the same results. In our case, more reliance on the direct comparison is warranted (see objective (ii) in the terms of reference, section 1.1)

6.2 Direct Comparison

For the purpose of making a direct test between RDF and FPC the two common dishes, *kaeng som* and *nam prik* of the previous tests were chosen. Two recipes one with RDF and one with FPC, for each dish were prepared and served to the respondents who were asked upon completing their meal to fill a test questionnaire analogous to the one used in the earlier tests of the new product against traditional preparations (see Appendix C). The results of these test are reported in Table 13 to 16.

The direct comparison of physical acceptability between the RDF and FPC is found in Table 13. Colour-wise RDF was prefered to FPC for both dishes. This preference was stronger in the case of the Jute-Mill. As a corollary, the relative index (FPC/RDF) was somewhat higher for Kasetsart. *Kaeng som* with FPC, in particular, was

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* This may be due partly to the acquired, by necessity, habit of the low-income people to eat much starch (rice) and little else (meat, fish and vegetables). Recall that the average income of the Jute Mill respondents was less than half that of the Kasetsart respondents.

Table 13 Direct Comparison of Physical Acceptability Between Roller-Dried Fish and Fish Protein Concentrate-Type B.

Acceptability index	Ka[illegible]iversity			Jute Mill			Combined total average
	Kaeng som	*Nam prik*	Total average	*Kaeng som*	*Nam prik*	Total average	
A. <u>Colour</u>							
Absolute index of RDF	.676	.756	.716	.697	.789	.743	.730
Absolute index of FPC	.644	.609	.627	.647	.609	.623	.625
Relative index of FPC	.953	.806	.876	.928	.772	.838	.856
B. <u>Consistency</u>							
Absolute index of RDF	.662	.730	.696	.630	.768	.699	.698
Absolute index of FPC	.636	.640	[illegible]	.693	.653	.673	.656
Relative index of FPC	.964	.877	.918	1,100	.850	.962	.940
C. <u>Taste</u>*							
Absolute index of RDF	.647	.706	.677	.667	.747	.707	.692
Absolute index of FPC	.616	.586	.601	.642	.609	.626	.614
Relative index of FPC	.952	.830	[illegible]	.963	.815	.885	.887
D. <u>Smell</u>							
Absolute index of RDF	.628	.710	.667	.692	.742	.707	.688
Absolute index of FPC	.611	.595	.603	.653	.614	.634	.619
Relative index of FPC	.973	.833	.901	.972	.877	.897	.899
E. <u>Total average</u>*							
Absolute index of RDF	.653	.726	.690	.667	.762	.715	.703
Absolute index of FPC	.627	.599	.613	.659	.621	.640	.627
Relative index of FPC	.960	.825	.888	.988	.815	.895	.891

* Note the similarity between 'taste' and 'total average'.

TRD : Traditional (preparation)
RDF : Roller-Dried Fish
FPC : Fish Protein Concentrate
Source : Computed according to formulas (3.2) and (3.3) from figures given in Appendix E (Table E.3)

found to be only marginally inferior to *kaeng som* with RDF as indicated by the relative index of acceptability : 0.953 by Kasetsart and 0.928 by the Jute Mill. *Nam prik* with FPC was rated clearly below *nam prik* with RDF both in absolute and in relative terms (the average indexes were 0.609 and 0.789 respectively for FPC compared with 0.773 and 0.941 for RDF).

In terms of consistency, RDF was preferred to FPC only in the case of *nam prik*. The consistency of *kaeng som* with FPC was rated by the Jute Mill respondents as superior to *kaeng som* with RDF (FPC/RDF index = 1.100). The Kasetsart sample also rated the consistency of FPC *kaeng som* high but still slightly below RDF (relative index of 0.964). The Jute-Mill sample rated both FPC dishes and RDF *nam prik* higher than did the Kasetsart sample which had more appreciation for the consistency of RDF with *kaeng som*.

The taste of the two preparations whether with RDF or FPC was more acceptable by the Jute-Mill sample than by the Kasetsart sample. Their was little difference between the two samples in the rating of the two products : both felt that *kaeng som* tastes almost as good with a FPC as it tastes with RDF while *nam prik* tastes clearly better with RDF. This comparative situation prevailed with smell as well, except that both groups felt that the smell of FPC dishes was even closer to the smell of RDF dishes than it was the case with taste.

In total, i.e. when all aspects are combined the following conclusions may by drawn:

(i) the Jute-Mill sample rated both RDF and FPC preparations somewhat higher than Kasetsart did;

(ii) RDF preparations were rated higher than FPC preparations by both samples (average index of 0.703 and 0.627 respectively);

(iii) both samples preferred *nam prik* with RDF and *kaeng som* with FPC;

(iv) both samples felt that there was little difference between *kaeng som* with FPC and *kaeng som* with RDF (average relating index RDF/FPC = 0.970); and

(v) surprisingly, but in agreement with our earlier findings, consistency is the most acceptable aspect of FPC and taste is the least;

while colour and smell are respectively the most and the least acceptable properties of RDF.

Table 14 provides a direct comparison of revealed acceptability (based on leftovers). Although *kaeng som* with either RDF or FPC appears to be more acceptable than *nam prik* small differences in the index should not be counted since, as mentioned earlier, *nam prik* is not a preparation to be consumed to the last drop; unlike *kaeng som*, which is akin to a soup, *nam prik* is a spicy dip and hence more leftovers should be expected. Thus the small difference in the index between RDF *kaeng som* and RDF *nam prik* for Kasetsart should not be taken seviously. The poor performance of *nam prik* at the Jute Mill may have been partly due to the timing of the test (10 A.M. may be too early in the morning for a spicy dish of a rather strong taste). However, the difference in the revealed acceptability index between *kaeng som* and *nam prik* at the Jute Mill is too large to be dismissed altogether. The Kasetsart respondents found FPC more suitable for *kaeng som* (0.750) and RDF more suitable for *nam prik* (0.673) while the Jute Mill sample prefered both preparations with RDF (average index 0.643 compared to 0.609 for FPC).

Table 15 presents a direct comparison of economic acceptability between RDF and FPC. At the equal price of 4 baht per dish a majority of both samples preferred the two preparations with RDF. However, there is a significant difference in the intensity of preference between the two preparations. For instance, in the case of Kasetsart 47 percent of the respondents preferred *kaeng som* with RDF and 35 percent preferred it with FPC, while the respective percentages for *nam prik* were 65 percent and 18 percent. It is also worth noting the large percentage, 38 percent, of the Jute Mill sample which expressed indifference as to which one of the two fish products goes into the two preparations. Overall, at an equal price RDF is preferred to FPC at the ratio of two to one (2:1).

Upon a hypothetical reduction of the price of FPC preparations by 25 percent, to 3 baht per dish, while keeping the price of RDF preparations at 4 baht per dish, the majority of both samples preferred *kaeng som* with FPC (44.0 percent) to *kaeng som* with RDF (35 percent) while another 16 percent were indifferent between the two. Indifference

Table 14 Direct Comparison of Revealed Acceptability Between Roller-Dried Fish and Fish Protein Concentrate-Type B.

Acceptability index	Kasetsart University			Jute Mill			Combined total average
	Kaeng som	*Nam prik*	Total average	*Kaeng som*	*Nam prik*	Total average	
Absolute index of RDF	.696	.673	.685	.763	.438	.601	.643
-rank	2	3	-	1	4	-	-
Absolute index of FPC	.750	.621	.686	.750	.312	.531	.609
-rank	1	2	-	1	3	-	-
Relative index of FPC	1.078	.923	1.001	.983	.712	.884	.947
-rank	1	3	-	2	4	-	-
<u>Leftovers</u>							
1. FPD < RDF	29.1	29.8	29.5	29.3	11.4	20.4	24.9
2. FPC = RDF	38.7	27.3	33.0	42.0	50.3	46.2	39.6
3. FPC > RDF	28.6	42.4	35.5	28.0	38.3	33.2	34.4
4. Unrecorded	3.6	0.5	2.1	0.7	0.0	0.4	1.2
Rank of RDF (row 3)	3	1	-	4	2	-	-
Rank of FPC (row 1)	3	1	-	2	4	-	-

RDF : Roller - Dried Fish

FPC : Fish Protein Concentrate

Source : Records of 'Leftovers' from RDF vs. FPC tests. Top part of Table Computed according to formula (3.7)

Sample size	199	198	-	150	149	-	-
A. $P_{FPC} = P_{RDF}$							
1. RDF	46.7	64.6	55.7	34.0	54.4	44.2	50.0
2. FPC	35.2	18.2	26.7	24.7	11.4	18.1	22.4
3. Either	14.1	13.6	13.9	38.0	31.5	34.8	24.4
4. Uncertain	4.0	3.5	3.8	3.3	2.7	3.0	3.4
Rank of RDF	3	1	-	4	2	-	-
Rank of FPC	1	3	-	2	4	-	-
B. $P_{FPC} = 0.75\ P_{RDF}$							
1. RDF	41.2	61.6	51.4	29.3	51.7	40.5	46.0
2. FPC	48.7	33.3	41.0	39.3	20.8	30.1	35.5
3. Either	5.0	2.5	3.8	27.3	24.8	26.1	15.0
4. Uncertain	5.0	2.5	3.8	4.0	2.7	3.4	3.6
Rank of RDF	3	1	-	4	2	-	-
Rank of FPC	1	3	-	2	4	-	-
C. $P_{FPC} = 0.50\ P_{RDF}$							
1. RDF	31.2	48.5	39.9	24.0	42.3	33.1	36.5
2. FPC	58.3	45.5	51.9	44.7	28.9	36.8	44.3
3. Either	5.0	2.5	3.8	26.0	25.5	25.7	14.8
4. Uncertain	5.5	3.5	4.5	5.3	3.4	4.4	4.5
Rank of RDF	3	1	-	4	2	-	-
Rank of FPC	1	2	-	3	4	-	-

RDF : Roller-Dried Fish
FPC : Fish Protein Concentrate
P : Price
Source : Computed according to formula (3.4) from figures given in Appendix E (Table E.3).

continued to be considerably higher at the Jute Mill although reduced down to 27 percent from the previous level of 35 percent. The price reduction, however, did very little to diminish the popularity of *nam prik* with RDF although it gave an edge to FPC among those who were previously indifferent between RDF and FPC. Still RDF *nam prik* is preferred by over 50 percent of each sample; but, there was still a significant 33 percent of the Kasetsart sample which preferred FPC *nam prik*. Overall, at a price ratio of 4:3 (4 for RDF, 3 for FPC) RDF was still preferred to FPC at the ratio of 4:3.

Last, when the price of FPC preparations was hypothetically reduced down to 2 baht per dish while keeping the price of RDF preparations constant at 4 baht per dish, 58 percent of the Kasetsart sample and 45 percent of the Jute Mill sample said they preferred *kaeng som* with FPC to *kaeng som* with RDF. The lower percentage in the case of the Jute Mill was not due to a strong preference for RDF *kaeng som*, but to the fact that 26 percent of the Jute Mill respondents continued to express indifference between the two fish ingredients. *Nam prik* on the other hand, was still more popular when prepared with RDF than with FPC, although this preference was only marginal in the case of Kasetsart. Overall, FPC preparations at half the price of RDF preparations are preferred, on the average, at the ratio of 5:4.

Table 16 reports the cross price elasticity of RDF and the own price elasticity of FPC which reflect, the percentage change in(economic) acceptability of RDF and FPC, respectively, due to a one percent change in the price of FPC while keeping RDF price constant. All cross elasticities for RDF are less than one, reflecting some reluctance to switch from RDF to FPC preparations as RDF becomes relatively more expensive with the reduction of the price of FPC. This reluctance is stronger in the case of *nam prik* but is relaxed with further reductions in the price of FPC. In general, RDF preparations are more (cross) price elastic at a price of FPC of 3 baht per of dish than at a price of 4 baht per dish. The FPC own elasticities of acceptability are in general, larger than one indicating that a one percent reduction in the price of FPC preparations, results in an increase of FPC's acceptability by more than one percent. At first glance, it is surprising that the own price elastici-

Table 16 RDF Cross Price Elasticity and FPC Own Price Elasticity

Site/preparation	Cross Price Elasticity of Roller Direct Fish		Own Price Elasticity of Fish Protein Concentrate	
	At P_{RDF} = 4 ฿ P_{FPC} = 4 ฿	At P_{RDF} = 4 ฿ P_{FPC} = 3 ฿	At P_{RDF} = 4 ฿ P_{FPC} = 4 ฿	At P_{RDF} = 4 ฿ P_{FPC} = 3 ฿
<u>Kasetsart University</u>				
Kaeng som	0.53	0.73	-1.53	-1.69
Nam prik	0.19	0.34	-1.66	-1.10
Total average	0.36	0.57	-1.60	-1.40
<u>Jute Mill</u>				
Kaeng som	0.55	0.54	-2.36	-0.41
Nam prik	0.20	0.55	-3.30	-1.17
Total average	0.38	0.55	-2.83	-0.79
<u>Combined average</u>	0.37	0.56	-2.22	-1.10

RDF : Roller-Dried Fish; FPC : Fish Protein Concentrate; P : Price
฿ : Baht, the Thai currency; US$1 = 20 baht (approximately)
Source : Computed according to formula (3.5) from the figures given in Table 15.

ties for FPC preparations are lower at 3 baht per dish than at 4 baht per dish, since we have already seen that the respondents were more eager to switch away from RDF when the price of FPC preparations was 3 baht per dish. The source of the discrepancy was the massive switch of many indifferent respondents to FPC at the first price iteration.

In conclusion, there is no doubt that, at an equal price, the majority of the respondents prefer the preparations with RDF over those with FPC. However, a 25 percent reduction in the price of FPC dishes was sufficient to give FPC a lead in the case of *kaeng som*. At half the price of *kaeng som* with RDF, *kaeng som* with FPC was quite popular. This is an important result considering that, in fact, FPC costs approximately half as much as RDF. However, fish is only one of the ingredients in *kaeng som*. Depending on FPC's share in the cost of preparation of *kaeng som*, the price advantage of FPC may or may not be sufficient to induce the consumers to choose it over RDF or over the traditional dishes, for that matter. FPC appears to be rather unacceptable for *nam prik* especially at the Jute Mill where despite a fifty percent reduction in its price it was still preferred by less than 30 percent of the sample. Thus, all concepts of acceptability--physical, revealed, and economic—point to the same conclusion that FPC is more acceptable for *nam prik* while RDF is acceptable for both *kaeng som* and *nam prik* but it has a comparative advantage for *nam prik*. This conclusion is not in conflict with the conclusion drawn from the indirect comparison (section 6.1), while it makes more justice to FPC.

6.3 Assessment

After having tasted the four preparations with each product, the respondents were asked to complete the 'Assessment' questionnaire (see Appendix D). They were shown the new product in a package with a price tag, and they were asked to make an overall assessment of the product. More specifically, the respondents were asked to state whether they will buy the new product at the quoted price, in what food preparations do they plan to use it and with what frequency; whether a lower price would induce them to buy and use the product more frequently; and, what they themselves thought was a fair price for the product. The

results are reported in Table 17.

As expected, given our earlier findings, *kaeng liang* topped the list of possible uses of RDF. About 90 percent of each sample indicated that if RDF becomes available at the price of 2 baht per package they could buy it and use it for preparing *kaeng liang*. Also as expected, *kaeng luang* was the least popular dish for RDF barely 60 percent of the respondents expressed interest in buying RDF for use in cooking *kaeng luang* consistent with our findings, *nam prik* was second in popularily with about 84 percent of the respondents and *kaeng som* third with about 75 percent of the respondents.* No significant differences in intended purchase and use of RDF between the two samples were observed.

The case of Fish Protein Concentrate was quite different. Except for *kaeng kua* there was considerable discrepancy between the preferences of the two samples: 82 percent of the Kasetsart sample expressed interest in buying and using FPC for preparing *kaeng som*, a dish which was popular among less than 72 percent of the Jute-Mill sample. Over 82 percent of the latter intend to use FPC in preparing *nam prik*. Less than 73 percent of the same sample were interested in using FPC for preparing either *kaeng kua* or *kaeng kare*. In fact, the latter was, in the case of the Jute Mill, the least popular dish with only 67 percent of the sample expressing interest. These results are clearly in conflict with our earlier findings and call for some explanation. Recall that in Chapter 5 we found that the top FPC dishes were *kaeng kare* and *kaeng kua*, in that order. Now, we are finding that these two dishes are at the bottom with *kaeng kare* last. What went wrong ?

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* Recall that the physical acceptability index during the comparison with the traditional dishes and all indexes during in the comparison between the new products indicated a preference for RDF *nam prik* over RDF *kaeng som* only the economic acceptability index in the first case favored the latter.

Table 17. Assessment of Roller-Dried Fish and Fish Protein Concentrate

(In percentages)

	Roller-Dried Fish			Fish Protein Concentrate		
	Kasetsart University	Jute Mill	Total average	Kasetsart University	Jute Mill	Total average
Sample size (in number of persons)	216	195	-	156	151	-
A. Preparations for intended use						
Kaeng som	73.6	75.6	74.6	82.1	71.5	76.8
Kaeng luang	60.6	57.7	59.2	-	-	-
Nam prik	85.2	82.7	84.0	74.4	82.1	78.3
Kaeng liang	90.3	89.7	90.0	-	-	-
Kang kua	-	-	-	72.3	72.8	72.5
Kaeng kare	-	-	-	72.9	67.0	70.0
B. Intended frequency of use						
≥ 4 times a week	13.4	14.1	13.8	9.2	12.6	10.9
2-3 times a week	50.5	52.5	51.5	51.3	57.0	54.2
Once a week	23.6	22.4	23.0	26.6	19.2	22.9
Once or twice a month	6.9	4.5	5.7	5.1	4.6	4.9
Rarely	5.6	11.5	8.5	7.7	6.6	7.2
C. At lower prices						
Will use more	57.4	42.9	50.2	42.1	37.7	39.9
Will use the same	34.4	44.9	39.7	51.3	48.3	99.6
Uncertain	8.3	11.5	9.9	6.7	12.6	9.7
No answer	0.0	0.6	0.3	0.0	1.3	.7
D. Fair price						
1.00 baht/package[1]	2.3	1.9	2.1	1.0	1.3	1.2
1.50 baht/package	8.3	3.2	5.8	21.0	8.6	14.8
2.00 baht/package	30.6	34.0	32.3	26.7	22.5	24.6
2.50 baht/package	7.9	7.7	7.8	31.3	16.6	24.0
3.00 baht/package	37.0	36.5	36.8	31.3	38.4	34.9
3.50 baht/package	10.6	15.4	13.0	5.6	8.6	7.1
Other	2.8	1.3	2.05	0.0	1.3	0.7
No answer	0.4	0.0	0.2	0.0	1.3	0.7

1. One package makes 6 dishes

There are several explanations of the above discrepancy:

(i) the respondents were inconsistent in the expression of their preferences;

(ii) unlike previous indexes which took into account both the popularity of each preparation and the intensity of preference by each respondent, the present index (intended purchase and use) considers only popularity, that is, the percentage of the sample which would buy and use FPC for any given preparation, but it says nothing about the frequency of use;

(iii) very poor performance of a traditional dish may have caused overvaluation of the corresponding new preparations, during the earlier tests;

(iv) it could by that many respondents thought that FPC had a higher potential for certain dishes than it was achieved during the tests and they intend to try preparing the dish with FPC on their own; and

(v) in tasting the preparations the respondents took into account only their own tastes while when considering the use of FPC at their homes they took into account their family's preferences as well.

The first reason above is unlikely given the consistency with which the samples responded throughout the tests. All the other reasons, however, may have played a part in this 'switching of preferences'. Indeed, *kaeng kare* and *kaeng kua* were the most 'intensively' liked FPC preparations but not clearly the most popular in terms of the number of people who considered them acceptable. It is also true that the traditional *kaeng kare* was rated very low which gave some boost to the rating of the new preparation, even in absolute terms, through unconscious comparison. The last two reasons are also very likely. *kaeng som* and *nam prik* are traditionally more popular dishes, eaten more regularly then either *kaeng kua* or *kaeng kare*, which are eaten regularly by some and occasionally by others. Although the respondents liked the latter two dishes with FPC as much as their traditional versions and more than other FPC dishes it does not follow that they all would like to prepare these dishes for their families if they have not

been part of their regular diet, this is precisely the information sought through the assessment questionnaire. In any case, it is encouraging that as many as 70 percent of the respondents intend to buy and use FPC for all four preparations tested. In this sense, FPC scored better than RDF for which only 59 percent of the sample expressed intention to use it in all four preparations tested.

Approximately 14 percent of the overall sample expressed intention to use RDF at least four times a week compared to 11 percent for FPC. However, a slightly larger percentage (54.2) wanted to use FPC 2-3 times a week than RDF (51.5 percent). In total, 65 percent of each sample said they intend to use RDF and FPC at least 2 times a week, while another 23 percent was planning once-a-week use; the rest said they will use the two products once a month or less. Thus, there was virtually no difference in the intended frequency of use between RDF and FPC. The Jute-Mill sample intended to use both products, but especially FPC, more regularly than Kasetsart: 70 percent of the former said they will use FPC at least twice a week compared to 61 percent at the latter.

Fifty percent of the respondents indicated that they would use RDF more if its price was lower than two baht per package, compared to only 40 percent for FPC. The price response was stronger at Kasetsart where 57 percent of the sample said they would use more RDF at a lower price compared to only 43 percent at the Jute-Mill. The difference between the two samples in the case of FPC was smaller.

However, when requested to state what they themselves considered as a fair price for the new products, only 8 percent of the respondents in the case of RDF and 16 percent in the case of FPC gave a price lower than two baht per package. In fact, almost 60 percent thought a fair price for each product should be over 2 baht per package. The mean price suggested was 2.50 baht and the mode price 3.00 baht per package. No significant differences between the samples were observed.

Finally, over ninety percent of each sample said they would recommend both RDF and FPC to their friends and neighbors. The authors have observed throughout the tests considerable enthousiasm among the respondents regarding the potential uses of the two new fish products.

CHAPTER 7

RELATING ACCEPTABILITY TO SOCIO-ECONOMIC BACKGROUND

As we have observed considerable variation in the acceptability of each product both between samples and within each sample, we proceed to investigate the extent to which differences in the socio-economic background of the respondents can explain differences in product acceptability. To do this, we followed several steps: First, we drew a random subsample of 50 respondents from each sample, we stratified it into groups according to demographic profile, eating habits and socio-economic conditions and computed the physical acceptability indexes for each group. Then, having observed significant differences in acceptability levels between groups we tried to explain these differences through regression analysis as explained in section 3.3 of the analytical framework (Chapter 3). Finally, given that our samples included only adults and that eating habits and tastes are believed to more flexible among children we tested the (revealed) acceptability of RDF and FPC among 150 school-children, as well. The results of these three exercises are reported in the above order.

7.1 Stratification of Sample

Tables 18 and 19 indicate the physical acceptability levels of RDF and FPC* among the fifty randomly selected respondents from each sample respectively, grouped by demographic profile, eating habits and socio-economic conditions. Because of the reduced sample size, an index difference of less than 0.050 is not considered significant. Table entries with significantly higher levels of acceptability are indicated by asterisks.

There is little point in going through every group describing these differences which can easily be seen through the casual viewing of the Tables. We will, instead summarize the highlights:

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* Obtained as the average of the acceptability indexes for the individual dishes tested for each product.

First, certain variables appear to be more important than others. In the case of Kasetsart (Table 18), sex, age, residence, price responsiveness, origin, and share of expenditure on fish in total expenditure appear to be more significant than type of work, family size, fish-eating frequency, total expenditure or expenditure on food. In the case of the Jute Mill (Table 19), sex, type of work, fish-eating frequency, origin and total expenditure were the most significant variables.

Second, though not without exception the pattern at Kasetsart was for the new products to be more acceptable among women, the young (under 30), those residing outside the place of work, those who were more sensitive to price differences, those who came from the Central Region or the South and those whose fish expenditure as a percentage of total expenditure was above average. There also appeared to be a stronger preference for FPC among those who cooked their own food than among those who had others cook for them. The pattern at the Jute Mill was for the new products to be more acceptable among the women,* the skilled workers, those who ate fish frequently, those who came from the North, the Northeast or Bangkok and those who had total expenditure above 1,500 baht per month. There was also a stronger preference for FPC among the married and, for both FPC and RDF, among the older, than among the single and the young respectively.**

Third, during the RDF & FPC comparison while there were many cases in which two demographic or socio-economic groups differed in their level of acceptability of both RDF and FPC or of FPC alone, there was only two cases in which they differed in their evaluation of only RDF. Respondents with a small family (Kasetsart) and those who did their own cooking (Jute Mill) rated RDF higher than those with large families and those who had others cooked for them respectively. FPC, on the other hand, was rated higher at Kasetsart by those who did their own cooking, those who had total expenditure between 1,500 and 3,000 baht

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* Actually the sample of men was too small to be representative.
** As ~~the results of the indirect comparison of FPC and RDF i.e.~~

Table 18 Physical Acceptability of RDF and FPC Among Fifty Kasetsart Respondents Grouped According to Socio-Economic Background.

	Sample size	Traditional vs. RDF			Traditional vs. FPC			RDF vs. FPC		
		Trad.	RDF	RDF/Trad.	Trad.	FPC	FPC/Trad.	RDF	FPC	FPC/RDF
A. <u>Sex</u>										
1. Male	10	.695	.541	.778	.723	.494	.683	.631	.650	1.030*
2. Female	40	.764*	.609*	.797	.804*	.544*	.677	.674	.612	.910
B. <u>Age</u>										
1. Under 30	23	.697	.614*	.843*	.769	.553	.719*	.661	.632	.955
2. Over 30	27	.772*	.579	.750	.803	.518	.644	.606	.609	.915
C. <u>Residence</u>										
1. In-resident	15	.723	.595	.823	.769	.480	.625	.694	.589	.989
2. Out-resident	35	.633	.595	1.116*	.796	.557*	.700*	.651	.633	.912
D. <u>Type of work</u>										
1. Unskilled	23	.725	.565	.780	.790	.522	.661	.659	.614	.932
2. Skilled	27	.771	.620*	.804	.794	.544	.685	.668	.624	.934
E. <u>Marital status</u>										
1. Single	9	.703	.663*	.943*	.746	.523	.670	.611	.545	.892
2. Married	41	.760*	.680	.763	.797	.537	.673	.675*	.636*	.941
F. <u>Family size</u>										
1. ≤ 4 members	22	.700	.612	.874*	.813	.549	.675	.695*	.625	.900
2. > 4 members	23	.789*	.582	.737	.768	.522	.680	.635	.615	.962

Table 18 (Continued)

	Sample size	Traditional vs. RDF			Traditional vs. FPC			RDF vs. FPC		
		Trad.	RDF	RDF/Trad.	Trad.	FPC	FPC/Trad.	RDF	FPC	FPC/RDF
G. Fish eating										
1. 4-7 times/week	11	.771	.619	.803	.837*	.553	.660	.688	.619	.901
2. < 4 times/week	39	.744	.588	.790	.774	.529	.683	.666	.619	.942
H. Price Response										
1. More fish if P↓	24	.750	.610*	.813*	.809*	.565*	.699*	.687*	.658*	.958
2. Not more if P↓	26	.749	.553	.738	.728	.446	.612	.598	.510	.852
I. Cooking										
1. Respondent	24	.766	.618	.808	.830*	.568*	.685	.689	.680*	.987
2. Others	26	.735	.573	.779	.749	.502	.671	.641	.564	.880
J. Origin										
1. South/Center	24	.773*	.620*	.801*	.816*	.566*	.694*	.712*	.694**	.834
2. North/Northeast	5	.563	.583	1.036**	.646	.432	.669	.542	.604	1.115**
3. Bangkok	23	.755*	.559	.740	.775*	.481	.621	.690	.609	.970*
K. Total expenditure										
1. ≤ 1,500	13	.718	.568*	.792	.793	.504	.635	.668	.558	.835
2. 1,501-3,000	23	.788*	.618*	.785	.811*	.543	.669	.679	.662*	.974
3. > 3,000	14	.718	.518	.810	.744	.548	.736	.634	.607	.958
L. Engels coefficient[1]										
1. ≤ 0.649[2]	21	.746	.578	.775	.751	.519	.691	.655	.585	.833
2. > 0.649	29	.753	.607	.807	.814*	.545	.669	.670	.644*	.961*

Table 18 (continued)

	sample siae	Traditional vs. RDF			Traditional vs. FPC			RDF vs. FTC		
		Trad.	RDF	RDF / Trad.	Trad.	FPC	FPC / Trad.	RDF	FP:	FPC / RDF
M. Fish expendit. share										
1. ≤ 0.223[3]	25	.724	.600	.828*	.761	.477	.626	.596	.563	.943
2. > 0.223	25	.776*	.590	.761	.814*	.591*	.726*	.731*	.673*	.925
N. Total Average	50	.750	.595	.793	.799	.534	.678	.664	.611	.933

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* Indicates that the entry is significantly different (higher) than the smaller non-bearing-asterisk entry in the same section (a difference of less than 0.050) is considered insignificant

**Indicates that the entry is significantly different (higher) than all other entries in the same section, including those with one asterisk.

1. Expenditure on food ÷ total expenditure.
2. Average value of Engel's coefficient.
3. Average share of expenditure on ~~food~~ fish in expenditure on food.

Table 19 Physical Acceptability of RDF and FPC Among Fifty <u>Jute-Mill</u> Respondents Grouped According to Socio-Economic Background

	Sample size	Traditional vs. RDF			Traditional vs. FPC			RDF vs. FPC		
		Trad.	RDF	RDF/Trad.	Trad.	FPC	FPC/Trad.	RDF	FPC	RDF/FPC
A. Sex										
1. Male	2	.703	.484	.689	.664	.453	.682	.502	.531	.872
2. Female	48	.837*	.628*	.751*	.794*	.599*	.755*	.701*	.622*	.887*
B. Age										
1. Under 30	26	.815	.597	.733	.789	.587	.744	.701	.572	.817
2. Over 30	24	.850	.650*	.765	.788	.600	.761	.674	.668*	.962*
C. Residence										
1. In-resident	46	.828	.621	.749	.788	.595	.754	.694	.613	.883
2. Out-resident	4	.867	.645	.743	.793	.578	.729	.734	.672*	.915
D. Type of work										
1. Unskilled	37	.827	.591	.714	.765	.556	.729	.668	.572	.856
2. Skilled	13	.844	.713*	.845*	.857*	.696*	.812*	.731*	.750*	.960*
E. Marital status										
1. Single	27	.823	.610	.741	.769	.558	.727	.654	.586	.896
2. Married	23	.841	.637	.758	.813	.634*	.781*	.749	.656*	.876
F. Family size										
1. ≤4 members	30	.818	.611	.747	.775	.578	.745	.717	.594	.829
2. >4 members	20	.852	.639	.750	.809	.617	.763	.669	.655*	.976*

Table 19 (continued)

	Sample size	Traditional vs. RDF			Traditional vs. FPC			RDF vs. FPC		
		Trad.	RDF	RDF/Trad.	Trad.	FPC	FPC/Trad.	RDF	FPC	FPC/RDF
G. Fish eating										
1. 4-7 times/week	10	.853	.714	.837*	.819	.629	.769	.638	.675*	.982*
2. 4 times/week	40	.828	.600*	.724	.781	.584	.748	.700	.604	.863
H. Price Response										
1. More fish if P↓	41	.828	.627	.756	.786	.587	.707	.713*	.611	.857
2. Not more if P↓	9	.854	.604	.707	.800	.622	.777	.628	.653	1.040*
I. Cooking										
1. Respondent	14	.858	.638	.744	.804	.597	.743	.733	.643	.876
2. Others	36	.821	.616	.750	.783	.592	.756	.683*	.605	.890
J. Origin										
1. South/Center	30	.832	.588	.708	.760	.496	.652	.626	.578	.924*
2. North/Northeast	17	.836	.671*	.802*	.848*	.681*	.803*	.715*	.654*	.974**
3. Bangkok	3	.802	.857**	.734	.635*	.865**	.688*	.573	.833	
K. Total expenditure										
1. ≤1,500	19	.813	.596	.733	.739	.568	.769	.64	.559	.863
2. 1,5001-3,000	13	.820	.599	.730	.792*	.575	.725	.702*	.620*	.884
3. >3,000	18	.859	.667**	.777	.838*	.634*	.756	.746*	.679**	.910*
L. Engels coefficient[1]										
1. ≤0.649[2]	28	.843	.619	.735	.810	.608	.750	.718	.625	.871
2. >0.649	22	.817	.626	.767	.762	.575	.755	.672	.609	.907

Table 19 (continued)

	Sample size	Traditional vs. RDF			Traditional vs. FPC			RDF vs. FPC		
		Trad.	RDF	RDF/Trad.	Trad.	FPC	FPC/Trad.	RDF	FPC	FPC/RDF
M. Fish expendit. share										
1. ≤ 0.223[3]	30	.838	.629	.751	.803	.606	.755	.703	.631	.898
2. > 0.223	20	.822	.613	.745	.768	.575	.749	.680	.598	.868
N. Total Average	50	.832	.623	.749	.789	.593	.752	.693	.618	.886

* Indicates that the entry is significantly different (higher) than the smaller non-bearing-asterisk entry in the same section (a difference of less than 0.050) is considered in significant

**Indicates that the entry is significantly different (higher) than all other entries in the same section, including those with one* asterisk.

1. Expenditure on food ÷ total expenditure.
2. Average value of Engel's coefficient.
3. Average share of expenditure on ~~food~~ fish in expenditure on food.

and those who spend proportionately more on food. At the Jute Mill, FPC was rated higher among the older, the out-residents, the married, those of large families and the frequent fish eaters.

The above three observations are not intended to imply that a causation was found between the various socio-economic characteristics and the levels of acceptability. As it is well known, correlation (let alone association between averages) does not imply causation. What the above observations and the two Tables demonstrate is that there are differences in acceptability levels along socio-economic lines although such differences may or may not have their roots in socio-economic factors. In order to investigate this point further and determine to what extent differences in socio-economic factors can explain differences in acceptability levels we combined the two sub-samples and use multiple regression analysis.

7.2 Regression Analysis

As explained in section 3.3, a regression equation of the form (3.10) was specified expressing the index of acceptability of RDF and FPC as a linear function of:

(i) the acceptability of the corresponding alternative (traditional, FPC or RDF);*

(ii) expenditure on fish, expenditure on food, and total expenditure;

(iii) the price responsiveness of demand for fish;

(iv) eating habits, and,

(v) demographic characteristics (e.g. sex, age, marital status, residence, origin, type of work etc.)

Equation (3.10) was estimated using stepwise least-square regression techniques. The results for five successful regressions are reported in Table 20, along with the corresponding statistics of significance (t-ratios and R^2). Of the seventeen independent variables used to explain acceptability, three (residence, total expenditure, and expenditure on food) are not listed.

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* In the case of the direct 'RDF vs. FPC' test the absolute indexes of physical acceptability of these products in the 'new vs. traditional' tests were used as explanatory variables.

Table 20. Relating Acceptability to Socio-Economic Background: Results of the Regression Analysis

Socio-economic variables (independent factors)	RDF vs. TRD		FPC vs. TRD[1]	RDF vs. FPC[1]	
	A_{RDF}	V_{RDF}	A_{FPC}	A_{RDF}	A_{FPC}
Constant	39.494	-6.342	9.413	13.662	3.833
Acceptability of alternative	-	1.185	.529	.232	-
	-	(4.485)[2]	(5.133)	(5.145)	-
Acceptability in other tests	n.a.	n.a.	n.a.	-	.386
	n.a.	n.a.	n.a.	-	(9.902)
Expenditure on fish	-	13.627	-	-	.542
	-	(2.214)	-	-	(2.699)
Price responsiveness (high)	3.708	-	-	1.596	-
	(2.233)	-	-	(1.630)	-
Frequency of fish eating (high)	-3.603	-3.276	-2.117	-	-
	(2.432)	(-2.431)	(1.343)	-	-
Own cooking	1.829	-	2.305	-	-
	(1.308)	-	(1.394)	-	-
Sex (Male)	-4.240	-	-	-	2.320
	(-1.973)	-	-	-	(1.859)
Age (>30)	-	-1.993	-3.802	-	1.323
	-	(-1.670)	(-2.397)	-	(1.911)
Marital Status (single)	-	-	-	-1.778	-
	-	-	-	(2.079)	-
Origin (Central or South)	1.904	-	4.985	-	-
	(1.226)	-	(3.006)	-	-
Origin (Northeast or North)	2.922	-	4.170	-	-
	(1.686)	-	(2.198)	-	-
Family size (>4)	-	2.163	-	-1.754	-
	-	(1.802)	-	(-2.142)	-

Table 20 (continued)

Socio-economic variable (independent factors)	RDF vs. TRD		FPC vs. TRD[1]	RDF vs. FPC[1]	
	A_{RDF}	V_{RDF}	A_{FPC}	A_{RDF}	A_{FPC}
Type of work (unskilled)	-5.102	-	-2.996	-	-
	(-3.636)	-	(-1.926)	-	-
Test site (Jute Mill)	-	2.259	-	-	-
	-	(1.750)	-	-	-
Sample size	100	100	100	100	100
R^2	.301	.250	.412	.326	.540
F-ratio	5.479	5.162	9.219	11.466	27.869

1. The results of the regression analysis of revealed acceptability are reported as they were unsatisfactory presumably because 'hunger' is the prime determinant of leftovers.
2. Numbers in parentheses are t-ratios, indicating the level of significance of the corresponding coefficients.

Notation: A: Absolute index of physical acceptability (average index of colour, consistency, taste and smell for all four preparations tested).

V: Absolute index of revealed acceptability (all four preparations) combined.

TRD: Traditional (preparations); RDF: Roller-Dried Fish; FPC: Fish Protein Concentrate;

n.a.: Non applicable; - : Indicates that the coefficients on the corresponding independent variables were not statistically significant at the 90 percent level of significance, during earlier runs and hence were dropped from the final model.

As they were statistically insignificant in all five equations for which results are reported in Table 20. Three equations, all pertaining to revealed acceptability are not listed because of unsatisfactory results. Revealed acceptability in general (including that for RDF listed in Table 20)* cannot be explained by socio-economic factors because of the omission of a key determinant of leftovers, 'hunger at the time of the test', on which we have no information.

The most satisfactory regression results were those for FPC (RDF vs. FPC test): As much as 54 percent of all variation in the absolute index of physical acceptability was explained by 4 variables: FPC's absolute acceptability during the FPC vs. Traditional test, expenditure on fish, sex, and age. It is not surprising for high acceptability of the same product in one test to be correlated with high acceptability in another test but this was not true of RDF. It is also a significant result that the higher the expenditure on fish, the higher the level of acceptability of FPC. Moreover, male respondents and those over 30 years of age, rated FPC at a significantly higher level than did women and younger respondents, respectively.

By comparison only 33 percent of the variation in the physical acceptability of RDF ('RDF vs. FPC test') was explained by the acceptability of the alternative (FPC) and by three socio-economic factors: price responsiveness, marital status, and family size. It is interesting that the acceptability of FPC rather than of RDF (in the 'New vs. Traditional' test) was a positive and more significant factor in the explanation of the acceptability of RDF in the 'RDF vs. FPC' test. Furthermore RDF was more acceptable among those who said they would eat more fish at lower fish prices, as well as among the married and those of smaller families. There are, however, no a priori theoretical reasons why it should be so and not otherwise; and, one should keep in mind that 67 percent of the variation in

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* It is listed as an example of the relative weakness of socio-economic factors to explain revealed acceptability levels (only 25 percent of the variation was explained in this case).

acceptability remains unexplained, compared to only 46 percent in the case of FPC.

Socio-economic factors were, also, more potent in explaining the variation in the acceptability of FPC than of RDF in the ' New vs. Traditional' tests. Six variables namely acceptability of the traditional dishes, age, fish-eating frequency, own cooking, origin, and type of work explained 41 percent of the variation in FPC acceptability, compared to only 30 percent of the variation in RDF explained by the latter four variables plus price responsiveness and age. The signs of the coefficients of the common variables were the same indicating that their qualitative effect on the acceptability of two products was identical. The higher the frequency of fish consumption the lower the acceptability of both FPC and RDF. Those who did their own cooking found the two products more acceptable. Those who came from the provinces (all 4 regions) had higher levels of acceptability for both products, (but especially for FPC) than those who came from Bangkok. Finally, acceptability of both products, but especially RDF, was higher among skilled workers, than among those without any skill.

7.3 Experimenting with a Third Sample

As it can be seen from Table 20 age is an important determinant of acceptability of the new products especially, in the case of FPC, though its effect is not always in the same direction. Even in theory, there is no agreement as to the role of age in taste formation. On the one hand, it could be argued that, the younger one is, the less likely he or she is to have formed rigid eating habits that leave little room for the introduction of new products especially if there is a marked difference in taste, smell, or consistency from the accustomed diet. On the other hand, one may argue that up to a point, at least, tastes are diversified with experience which comes partly with age; it is a commonly known fact, for instance, that adults learn to eat foods which they disliked intensely as children. Which of the two arguments is true in specific cases is an empirical question.

Although no formal testing of these hypotheses is intended here it was considered important to investigate the acceptability of the two new fish products among children, especially those attending primary school, for two reasons; (a) the reaction of children to the new products whether positive or negative is certain to affect their parents' decision to purchase and use them at home; (b) many pre-school and primary school children in Thailand are known to suffer from protein deficiency, which can be, at least partly, alleviated through the introduction of protein-rich products such as RDF and FPC in school-feeding programs.

For the purpose of testing the acceptability of RDF and FPC among children, a sample of 150 school-children seven to ten years old attending a primary school at the Kampangsaen Campus of Kasetsart University was selected. No direct comparison between RDF and FPC, or between them and traditional dishes, was attempted because of the very young age of the children. For the same reason no questionnaires were administered. The only information collected was in the form of left-overs. The meal served to each child and the amount of leftovers were carefully weighed and recorded. In total the children were served seven preparations of each new fish product on different days. The amount served and the amount eaten (obtained as the difference between the amount served and the leftovers) from each RDF and FPC preparation are reported in Table 21.

Based on the amount of each preparation eaten, the school-children appeared to prefer *nam prik pla*, *nam prik noom* and *kaeng som* with RDF, *khanom cheen nam ya* with FPC, and scrambled eggs, noodles with topping, and *tau chiew lon* with both RDF and FPC. Thus, both RDF and FPC preparations are acceptable to children. The level of acceptability is somewhat higher for RDF than for FPC, as it was also the case with the sample of adults.

Table 21 Revealed Acceptability of RDF and FPC Preparations Among 153 School-Children at the Kampangsaen Campus, of Kasetsart University (in grams)

	Nam prik pla	*Nam prik noom*	*Kaeng som*	*Tau chiew lon*	*Scrambled eggs*	*Noodles with topping*	*Khanom cheen nam ya*
RDF							
Amount served	75.0	75.0	175.0	100.0	70.0	300.0	220.0
Amount eaten	57.0	57.1	144.3	87.3	68.9	269.4	215.7
FPC							
Amount served	60.0	70.0	150.0	150.0	70.0	300.0	270.0
Amount eaten	43.7	41.8	129.9	89.9	65.9	265.6	261.7

CHAPTER 8

SUMMARY AND RECOMMENDATIONS

1. Summary

According to the terms of reference (see section 1.1) the objective of the project was three fold: (i) to develop comparable recipes based on traditional Thai food habits using Roller-Dried Fish (RDF) and Fish Protein Concentrate (FPC) as fish ingredients; (ii) to test the acceptability of these recipes vis-a-vis both their traditional counterparts and each other; and (iii) to determine the sensitivity of the acceptability levels to the relative costs of the preparations, and identify the price levels at which the consumers are willing to buy the new fish products.

In response to the first objective six popular Thai recipes were modified to incorporate RDF or FPC instead of fresh fish as their fish ingredient. The local names of the four recipes developed for RDF are: *kaeng som, nam prik, kaeng luang* and *kaeng liang*. The former two recipes were also developed for FPC along with two additional preparations, *kaeng kua* and *kaeng kare*. the detailed recipes appear in Appendix A.

In response to the second objective of the project, the acceptability of the four recipes for each new fish product were tested with a sample of 400 workers (mostly women) at Kasetsart University and at a factory in the suburbs of Bangkok. The new recipes were, first, tested against the corresponding traditional recipes with respect to their physical properties, colour, consistency, taste and smell. The respondents were served comparable new and traditional dishes and asked to complete a questionnaire on the intensity of their preference of the different aspects of these preparations. Based on this information and the popularity of each dish, absolute and relative indexes of acceptability were computed indicating respectively the level of acceptability of each new recipe by itself and in comparison to its traditional version. Records of leftovers were also used to compute a revealed acceptability index for each recipe.

RDF preparations were generally more acceptable than FPC preparations, both in absolute terms and in relation to their traditional counterparts. Second, all the RDF and FPC preparations tested were acceptable (above 'fair'), but they were generally liked less than the traditional dishes. (The only exception was *kaeng kare* with FPC which was preferred to its traditional counterpart). The difference, however, was not dramatic. Roughly speaking, on a scale from zero to ten (with 5 being 'fair') the traditional preparations averaged 8, the RDF preparations 7 and the FPC preparations 6.

The most popular RDF preparation was *kaeng liang* followed by *kaeng som* and *nam prik*. Over three-fourths of the sample said they intend to buy and use RDF when preparing these dishes. In contrast, *kaeng luang* with RDF was barely acceptable. Preferences were not as clear-cut in the case of FPC. Although the particular preparations of *kaeng kare* and *kaeng kua* with FPC served were more popular than either *kaeng som* or *nam prik* a larger percentage of respondents said they would buy and use FPC when preparing the latter two. This, however, is more a refection of the relative position of the corresponding traditional dishes in the Thai diet than a reflection of FPC's comparative advantage for the one or the other set of recipes. When the two common recipes of RDF and FPC tests were compared directly to each other, there was a preference for *nam prik* with RDF and *kaeng som* with FPC

The often advanced hypothesis that the rather 'sandy' consistency of FPC is a disadvantage of this new fish product was not supported by our findings. In fact, consistency was the most acceptable property of FPC and taste the least. In the case of RDF both colour and consistency were found more acceptable than either taste or smell.

In order to determine the sensitivity of the acceptability to the relative costs of the preparations (third objective of the project) the respondents were asked to express their preference between traditional and RDF dishes, between traditional and FPC dishes, and between dishes of the two new fish products, at different sets of relative prices. At an equal price, the traditional dishes were in general preferred to the RDF dishes, which in turn were preferred to the FPC dishes. *Kaeng kare* with

FPC was the only new preparation preferred to its traditional counterpart at an equal price and this was the case only at the factory. The acceptability of all new preparations, however, consistently rose as their price was reduced. At a price three-fourths of the corresponding traditional preparation the university workers preferred *kaeng liang* with RDF to traditional *kaeng liang*. At half the price of the traditional dish *kaeng som* with RDF was also more popular than the traditional *kaeng som* while *nam prik* with RDF was as acceptable as the traditional dish. The acceptability of FPC preparations was also very responsive to relative prices but even at half the price of the traditional preparations no FPC dish, other than *kaeng kare* (among factory workers), was as popular as the traditional dishes; still a substantial 30 to 40 percent of the sample expressed preference for the FPC preparations. As a measure of the price responsiveness of acceptability the concept of elasticity was introduced; it was found that *nam prik* with either RDF or FPC, and *kaeng som* with FPC were among the most price elastic preparations, that is, their acceptability rose considerably with small price reductions. As an overall assessment about three-fourths of the sample said they will buy and use RDF and FPC at home at a price of 2 baht per package (each package is sufficient for six preparations). They also expressed willingness to use them more often at a lower price but they thought a fair price should be at least 2.50 baht per package.

A last finding worth highlighting is the considerable variability in acceptability between samples and within each sample. RDF was rated higher by the Kasetsart sample than by the Jute Mill sample in terms of both physical and economic acceptability. FPC, on the other hand was rated higher by the Jute Mill than by Kasetsart also in terms of both physical and economic acceptability. The most popular RDF dishes were *kaeng liang* at Kasetsart and *nam prik* at the Jute Mill. Although there was concensus between the samples on the ranking of *kaeng kare* as the best FPC preparation its level of acceptability was considerably higher at the Jute Mill. These and other differences prompted an examination of the relationship between the respondents' socio-economic background and their level of acceptability of the new products through stratification of the sample, regression analysis, and acceptability

testing among school-children. Sex, age, origin, type of work, marital status, family size, fish-eating frequency, expenditure on fish and price responsiveness were among the significant explanatory factors of the variation in acceptability. The acceptability of RDF and FPC was found to be high (higher for RDF than FPC) among school-children especially in dishes such as scrambled eggs and noodles which incorporate the new fish products in a more subtle way than the dishes prepared for adults.

2. Recommendations

In conclusion both Roller-Dried Fish and Fish Protein Concentrate were acceptable but at a different level. The level of acceptability also depended on the type of preparations in which these new fish products were incorporated, on the cost of the preparations, the alternatives presented, and the socio-economic background of the respondents. All eight recipes developed and tested were acceptable but some were more acceptable than others. The level of acceptability of both RDF and FPC preparations was responsive to costs differences, a finding which favors the new fish products provided they can be produced at substantially lower cost than the conventional sources of protein. Moreover, the preparations RDF or FPC have the additional advantages of higher protein content and ease of preparation by virtue of their form which obviates the need for refrigeration, cleaning, and pounding or grinding before use.

According to the findings of the present study there is considerable scope for introduction of RDF and FPC in institutional feeding programs as well as directly in the market. There is also extensive scope for further research in the area to perfect the already developed and tested recipes and to develop and test additional ones as well as to identify the specific socio-economic groups among which the two fish products should be promoted first.

Therefore, it is recommended that a phase II be undertaken with the following objectives:

(i) to perfect the already developed recipes on the basis of suggestions made during the acceptability tests of the first phase;

(ii) to develop additional recipes, such as *homok* with RDF for higher-income groups as well to incorporate both RDF and FPC in preparations such as scramble eggs and *phat prik khing* in which fish is not normally used;

(iii) to promote the introduction of the new fish products, prefereably RDF in the earlier stages, in institutional feeding programs and to identify specific socio-economic groups which would be particularly receptive to an early introduction of new fish products.

(iv) to produce and market at least one of the new fish products, preferably Roller-Dried Fish, from local sources such as properly handled 'trashfish' suitable for human consumption, taking into account the results of the present study with respect to the preferences and price responsiveness of the consumers;

(v) to conduct a market acceptability study after the product has been placed in the market.

It is also recommended that due attention is paid to the costs of raw material ('trashfish') which is likely to rise as a result of the rising fuel prices, of the advancing depletion of fishery resources, and of the rising demand for 'trashfish' to which the present project would add, if successful on a large scale. Finally measures should be taken to manage the fishery resources so that the capture of immature edible fish, a major component of trash fish, be minimized. It is, after all, preferable and more economical to land larger quantities of fresh fish of a marketable size than to try to improve the utilization of prematurely caught fish. In the meanwhile, however, there is a considerable scope for the conversion of substantial quantities of properly-handled 'trashfish' into Roller-Dried Fish or Fish Protein Concentrate. Even with proper fish resource management, it is a feature of the tropical multi-species fisheries to land large quantities of 'unconventional' low-priced species, which find their way to the fishmeal plants and the duck farms. The two new fish products tested in this study were found to be acceptable means for better utilization of on untapped protein source in a protein-deficient country.

APPENDIX A.

DESCRIPTION OF RECIPES

Kaeng som (Mixed vegetables)

Ingredients

fresh fish 120 gm. or RDF 15 gm or FPC 25 gm	
yard-long bean, cut to pieces	30 gm
cabbage, cut to pieces	80 gm
turnip, cut to pieces	60 gm
fish sauce	3 tsp
coconut sugar	20 gm
tamarind pulp	3 tsp
water	3 cup
chili paste	
red onion (shallot)	27 gm
fermented shrimp paste	15 gm
red pepper	50 gm
wild ginger	26 gm

Procedure

1. Boil fresh fish, debone, pound
2. Pound chili paste ingredients to form a paste.
3. Bring water to boil, add 30 gm of chili paste
4. Add fresh fish or RDF or FPC bring to boil
5. Add vegetables
6. Add fish sauce, sugar

Kaeng luang

Ingredients

fresh fish 100 gm or RDF 20 gm	
wax gourd, cut to pieces	240 gm
fish sauce	2.5 tsp
coconut sugar	2 gm
tamarind pulp	6 tsp
water	3 cup
chili paste	
green hot pepper	25 gm
red onion (shallot)	15 gm
garlic	20 gm
fermented shrimp paste	20 gm
curcuma	4 gm
salt	1 tsp

Procedure

1. Boil fresh fish, debone, pound
2. Pound chili paste ingredients to gether
3. Bring water to boil, add 30 gm of chili paste
4. Add pounded fresh fish or RDF, bring to boil, add vegetable
5. Add fish sauce, sugar and tamarind pulp.

---

tsp = tablespoon.

Nam prik (Pla ra)

Ingredients

fresh fish 80 gm or RDF 20 gm or FPC 50 gm	
fermented fish	65 gm
green pepper	50 gm
garlic	20 gm
red onion (shallot)	30 gm
lime	6 tsp
fish sauce	3 tsp
water	3 cup

Procedure

1. Boil fresh fish, debone, pound
2. Boil fermented fish in water until soft, strain out the soup.
3. Char or toast green pepper, garlic, red onion, coursely pound.
4. Boil 1 cup of fermented fish soup, add fresh fish or RDF or FPC,
5. Remove from stove when boiled
6. Add pounded pepper, garlic and red onion.
7. Add fish sauce, lime juice
8. Serve with fresh or boiled vegetable.

Kaeng liang

Ingredients

fresh fish 100 gm or RDF	15 gm
red onion (shallot)	20 gm
fermented small shrimp	13.5 gm
pepper	1.2 gm
bottlegourd, cut to pieces	100 gm
angle-type gourd, cut to pieces	100 gm
pumpkin, cut to pieces	100 gm
holy leaves	10 gm
fish sauce	2 tsp
water	3 cup

Procedure

1. Boil fresh fish, debone, pound the meat
2. Pound red onion, fermented small shrimp and pepper to a paste
3. Boil water in a pan, add 30 gram of the paste.
4. Add fresh fish or RDF, bring to boil before adding vegetable.
5. Add fish sauce, holy leaves, remove from stove.

---

tsp = tablespoon.

Kaeng kua (Sour Bamboo shoot)

Ingredients

fresh fish 80 gm or FPC 25	gm
sour bamboo shoot cut to pieces	210 gm
shredded coconut meat	120 gm
leech leaves	0.5 gm
basil leave	10 gm
coconut sugar	2 gm
fish sauce	3 tsp
tamarind pulp	1 tsp
water	3 cup
chili paste	
dried chili pepper	7 gm
galangale	9.6 gm
bitter orange peel	2.9 gm
lemon grass	10 gm
red onion (shallot)	15 gm
fermented small shrimp	14 gm
garlic	13.4 gm
salt	1 tsp

Procedure

1. Boil fresh fish, debone, pound the meat.
2. Pound chili paste ingredients to a paste.
3. Prepare coconut milk, boil the first extract, add 30 gm of chili paste.
4. Add fresh fish or FPC, second extract of coconut milk, vegetables.
5. Bring to boil, add fish sauce and sugar.

Kaeng kare

Ingredients

fresh fish 80 gm or FPC	25 gm
yard-long bean, cut to pieces	60 gm
bamboo shoot, cut to pieces	60 gm
egg plant, cut to pieces	60 gm
cha-om leaves	60 gm
fish sauce	3 tsp
water	3 cup
chili paste	
dried chili pepper	7 gm
galangale	9.6 gm
lemon grass	10 gm
bitter orange peel	2.9 gm
red onion (shallot)	15 gm
fermented small shrimp	14 gm
garlic	13.4 gm
salt	1 tsp

Proceudre

1. Boil fresh fish, debone, pound the meat.
2. Pound chili paste ingredients to a paste
3. Boil water in a pan, add 30 gm of chili paste.
4. Add fresh fish or FPC, vegetable
5. Season with fish sauce.

---

tsp = tablespoon

Date :

Remark :

APPENDIX B.

QUESTIONNAIRE I : BACKGROUND

Name ______________________ Surname ______________

Sex ______________________ Age ______________

Place of residence ______________ Province you come from ______

Occupation ______________ Marital status ______________

Occupation of spouse (if married) ______________________

Total no, of persons in household ____________ Number of children ____

We come from the Institute of Food Technology and Product Development of Kasetsart University and we are making a survey to find out if new fish products would be acceptable to the Thai people. We will appreciate you answering the following questions carefully.

1. How often do you eat fish ?

   ( ) every day
   ( ) 4 - 5 times a week
   ( ) 2 - 3 times a week
   ( ) once a week
   ( ) twice a month
   ( ) rarely

2. If fish was cheaper would you have eaten more fish/more often ?

   ( ) yes
   ( ) no

3. Compare to other meats (chicken pork etc.) do you consider fish being:

   ( ) better food
   ( ) same
   ( ) not as good

4. When did you last eat fish

( ) today

( ) yesterday

( ) the day before

( ) 3 - 4 days ago

5. What kind of fish do you eat usually ? Write 1, 2, 3, 4, 5, ... in order of frequency of consumption ?

pla too ....

pla chon ....

one-eye-fish ....

pla kapong daeng ......

Blackbanded king fish

other (please indicate) ____________________

6. In what form do you buy your fish ? Write 1, 2, 3, in order of frequency of consumption ?

fresh ....

dried ....

smoked ....

fermented ....

salted ....

7. What fish dishes do you eat usually ? Write 1, 2, 3, ... in order of frequency of consumption ?

kaeng som ....

kaeng phet ....

phat pla ....

tom yam pla ....

nam prik ....

pla thod ....

pla nung ....

other (please indicate) ____________________

8. Who cook your family food ?

( ) yourself

( ) someone else

( ) buy ready-cooked food from outside all the time

( ) buy ready-cooked food from outside once in a while; how many times per month ....

9. How often do you try new preparations ?

( ) often

( ) sometimes

( ) rarely

( ) never

10. Do you feel it is necessary for a fish dish to contain big bits of fish ?

( ) yes

( ) no

11. Is there any time of the year you eat less fish ?

( ) yes when ? ______________________ why ? ____________

( ) no

12. How much does your family spend per month ?

(a) on fish ....________baht

(b) on meats (chicken, duck, pork, beef etc.).........________baht

(c) on all other foods (rice, vegetables, eggs, milk etc.)....________baht

(d) on "eat out" and "take-home" food ....________baht

(e) on all non-food items (clothes, transport, education etc.)......________baht

13. Does your family catch any fish from rivers, "klongs" etc. for your own use ?

( ) yes; approximately how many kilos per month ...____baht

( ) no

14. Does your family raise or obtain free from relatives any poultry, rice or vegetables for your own use ?

( ) yes; approximate value if sold ......________baht/month

( ) no

Thank you for your kind cooperation

Date :
Remark : A
B

APPENDIX C

QUESTIONNAIRE II : Test

First Name ______________________________

Surname ______________________________

Identification no ______________________________

We have prepared two dishes of ____________________, one in the usual way and one with a new product. Please taste the two dishes and answer the following questions:

1. How do you like the colour of dish

	A	B
very much	( )	( )
much	( )	( )
o.k. (fair)	( )	( )
not much	( )	( )
not at all	( )	( )

2. How do you like the consistency of dish

	A	B
very much	( )	( )
much	( )	( )
o.k. (fair)	( )	( )
not much	( )	( )
not at all	( )	( )

3. How do you like the taste of dish

	A	B
very much	( )	( )
much	( )	( )
o.k. (fair)	( )	( )
not much	( )	( )
not at all	( )	( )

4. How do you like the smell of dish

	A	B
very much	( )	( )
much	( )	( )
o.k. (fair)	( )	( )
not much	( )	( )
not at all	( )	( )

5. If preparation A and preparation B cost the same to prepare, which preparation do you prefer ?

( ) A, because ______________________________

( ) B, because ______________________________

( ) either

( ) not sure

6. If preparation A costs 4 bath and preparation B costs 3 bath, which preparation would you choose ?

( ) A

( ) B

( ) either

( ) not sure

7. It preparation A costs 4 bath and preparation B costs 2 bath, which preparation would you choose ?

( ) A

( ) B

( ) either

( ) not sure

8. Do you have any suggestions for the improvement of

		dish A	dish B
Use more :	fish	( )	( )
	chili	( )	( )
	salt	( )	( )
	tamarind	( )	( )
	pepper	( )	( )
	sugar	( )	( )
	----	( )	( )
Use less :	fish	( )	( )
	chili	( )	( )
	salt	( )	( )
	tamarind	( )	( )
	pepper	( )	( )
	sugar	( )	( )
	----	( )	( )

9. Would you like to taste some other preparations with the new product some other day ?

( ) yes

( ) may be

( ) no

Thank you for your kind cooperation

Date :

Remark :

APPENDIX D.

QUESTIONNAIRE III : ASSESSMENT

Name ____________________ Surname _________________________ I.D. No.____

The new fish product we have been testing with your help is in powder form. It is produced from fresh fish and comes in a package.* A package is sufficient for cooking about [illegible] dishes.

1. If this new product was available in the market at 2.00 baht per package would you buy it and use it at home when you cook:

	Yes	No	not sure
kaeng som	( )	( )	( )
kaeng luang	( )	( )	( )
nam prik pla ra	( )	( )	( )
kaeng liang	( )	( )	( )

2. What other dishes would you try to prepare with the new product ?

   1. ....
   2. ....
   3. ....

3. If you buy this product, how often would you use it in your cooking ?

   (   ) 6 - 7 times a week
   (   ) 4 - 5 times a week
   (   ) 2 - 3 times a week
   (   ) once a week
   (   ) once or twice a month
   (   ) rarely

---

* The interviewer should show the package and the content to the respondents.

4. If the price of this product was lower than 2.00 baht per package would you use it more often ?

   ( ) yes, I will use it more often
   ( ) no, I will not use it more often
   ( ) not sure

5. Considering that one package of the new fish product makes 6 dishes what do you think it would be a fair price per package ?

   ( ) 1.00 baht
   ( ) 1.50 baht
   ( ) 2.00 baht
   ( ) 2.50 baht
   ( ) 3.00 baht
   ( ) 3.50 baht
   ( ) other (please indicate) ______________________

6. Would you recommend this new fish product to your friends and neighbors ?

   ( ) yes
   ( ) no
   ( ) not sure

Thank you again for your kind cooperation.

APPENDIX E.

SUPPLEMENTARY DATA TABLES

Table E.1 Tabulation of Selected Test Results for Roller-Dried Fish in the Form of Frequency Distribution.

Preference	Kasetsart University				Jute Mill			
	Kaeng som	*Kaeng luang*	*Nam prik*	*Kaeng liang*	*Kaeng som*	*Kaeng luang*	*Nam prik*	*Kaeng liang*
Sample size	208	213	214	216	143	157	161	156
A. Colour of TRD								
Very much	87	72	77	67	73	80	81	82
Much	69	73	90	100	39	53	59	54
Fair	42	52	42	38	23	17	20	16
Not much	7	14	5	10	2	6	1	2
Not at all	4	2	0	0	0	1	0	1
Blank	0	0	0	0	6	0	0	1
B. Colour of RDF								
Very much	35	19	38	40	24	5	34	14
Much	69	59	84	104	35	35	51	59
Fair	88	108	78	64	58	92	66	72
Not much	13	24	11	8	10	19	9	8
Not at all	3	3	3	0	5	5	1	2
Blank	0	0	0	0	11	1	0	0
C. Consistency of TRD								
Very much	95	74	84	76	79	81	76	80
Much	74	99	96	97	36	55	63	55
Fair	34	33	31	39	18	18	22	16
Not much	4	5	2	4	3	3	0	4
Not at all	1	2	1	0	1	0	0	0
Blank	0	0	0	0	6	0	0	0
D. Consistency of RDF								
Very much	34	18	24	40	34	18	40	20
Much	66	63	72	96	32	45	46	57
Fair	92	100	99	75	52	67	69	66
Not much	14	29	13	4	10	22	6	8
Not at all	2	3	3	1	3	4	0	4
Blank	0	0	0	0	12	1	0	1
E. Taste of TRD								
Very much	103	85	92	72	74	74	82	91
Much	65	82	91	99	38	55	50	48
Fair	31	36	28	38	19	23	26	14
Not much	8	8	3	5	3	4	3	0
Not at all	1	2	0	2	0	1	0	2
Blank	0	0	0	0	9	0	0	1

Table 7.1 (continued)

Preference	Kasetsart University				Jute Mill			
	Kaeng som	*Kaeng luang*	*Nam prik*	*Kaeng liang*	*Kaeng som*	*Kaeng luang*	*Nam prik*	*Kaeng liang*
F. Taste of RDF								
Very much	20	20	12	46	28	9	34	15
Much	55	47	66	80	41	36	52	52
Fair	99	108	107	80	48	81	63	73
Not much	29	33	24	9	12	23	12	13
Not at all	4	5	5	1	12	7	0	2
Blank	1	0	0	0	12	1	0	1
G. Smell of TRD								
Very much	72	65	74	58	66	59	62	68
Much	91	87	102	103	41	54	62	65
Fair	35	53	35	44	28	38	34	19
Not much	9	5	3	11	2	4	3	3
Not at all	1	3	0	0	0	1	0	0
Blank	0	0	0	0	6	1	0	1
H. Smell of RDF								
Very much	19	18	10	39	33	10	23	11
Much	59	53	81	85	39	41	60	70
Fair	90	102	101	81	48	81	72	59
Not much	31	31	18	10	7	24	6	13
Not at all	9	9	4	1	13	1	0	2
Blank	0	0	0	0	3	0	0	1
I. $P_{RDF} = P_{TRD}$								
TRD	155	161	179	119	86	115	102	104
RDF	33	28	15	60	42	19	28	12
Either	20	12	19	36	11	22	29	39
Not sure	0	2	1	1	0	1	2	0
Blank	0	0	0	0	4	0	0	0
J. $P_{RDF} = 0.75\ P_{TRD}$								
TRD	132	138	157	100	74	105	81	96
RDF	60	63	47	107	53	35	47	28
Either	15	11	10	9	9	16	28	29
Not sure	0	1	0	0	6	1	4	3
Blank	0	0	0	0	1	0	1	0
K. $P_{RDF} = 0.5\ P_{TRD}$								
TRD	97	114	114	70	56	90	64	71
RDF	102	89	90	138	62	45	63	40
Either	5	7	10	7	16	17	26	37
Not sure	4	3	0	1	8	5	7	6
Blank	0	0	0	0	1	0	1	0

TRD: Traditional (preparation); RDF: Roller Dried Fish; P: Price.

Table E.2 Tabulation of Selected Test Results for Fish Protein Concentrate in the form of Frequency Distributions

Preference	Kasetsart University				Jute Mill			
	Kaeng kua	*Nam prik*	*Kaeng som*	*Kaeng kare*	*Kaeng kua*	*Nam prik*	*Kaeng som*	*Kaeng kare*
Sample size	211	204	200	195	151	148	146	151
A. Colour of TRD								
Very much	93	86	86	59	103	84	82	25
Much	94	101	97	100	44	53	58	49
Fair	22	17	15	32	3	10	6	67
Not much	2	0	1	4	0	1	0	9
Not at all	0	0	0	0	1	0	0	1
Blank	0	0	0	0	0	0	0	0
B. Colour of FPC								
Very much	13	9	5	17	21	6	5	34
Much	71	52	54	73	55	32	46	51
Fair	97	113	108	85	68	85	74	55
Not much	28	26	27	14	5	21	20	11
Not at all	2	4	6	6	1	4	1	0
Blank	0	0	0	0	1	0	0	0
C. Consistency of TRD								
Very much	89	75	85	58	75	67	63	30
Much	92	97	99	104	61	65	70	62
Fair	29	30	13	30	15	14	13	52
Not much	1	2	1	3	0	2	0	7
Not at all	0	0	2	0	0	0	0	0
Blank	0	0	0	0	0	0	0	0
D. Consistency of FPC								
Very much	16	7	7	14	29	17	6	31
Much	80	82	72	74	56	52	50	58
Fair	95	93	91	89	59	61	75	52
Not much	20	21	23	15	6	16	14	10
Not at all	0	1	7	3	1	1	1	0
Blank	0	0	0	0	0	1	0	0
E. Tast of TRD								
Very much	87	83	78	60	88	78	71	15
Much	91	101	100	97	51	62	64	53
Fair	32	19	19	33	11	7	11	64
Not much	1	1	1	5	1	1	0	16
Not at all	0	0	2	0	0	0	0	3
Blank	0	0	0	0	0	0	0	0

Table E.2 (continued)

Preference	Kasetsart University				Jute Mill			
	Kaeng kua	*Nam prik*	*Kaeng som*	*Kaeng kare*	*Kaeng kua*	*Nam prik*	*Kaeng som*	*Kaeng kare*
F. Taste of FPC								
Very much	8	9	6	14	15	6	5	33
much	47	46	49	52	47	36	37	42
Fair	113	122	96	93	76	84	75	56
Not much	41	22	32	32	10	19	27	16
Not at all	2	5	15	4	2	3	2	2
Blank	0	0	0	0	1	0	0	0
G. Smell of TRD								
Very much	71	74	79	55	69	62	57	18
much	101	107	100	92	71	69	67	55
Fair	37	22	19	44	10	16	18	63
Not much	2	1	1	4	0	1	3	13
Not at all	0	0	1	0	1	0	1	2
Blank	0	0	0	0	0	0	0	0
H. Smell of FPC								
Very much	12	6	8	14	12	12	7	29
much	62	56	52	53	61	38	41	51
Fair	98	108	96	92	65	78	73	53
Not much	34	29	31	27	12	15	19	16
Not at all	5	5	13	9	1	5	6	2
Blank	0	0	0	0	0	0	0	0
I. $P_{RDF} = P_{TRD}$								
TRD	177	174	168	152	101	110	119	45
FPC	18	13	11	21	19	8	3	63
Either	15	17	17	21	29	28	21	35
Not sure	1	0	4	1	2	2	1	8
Blank	0	0	0	0	0	0	2	0
J. $P_{RDF} = 0.75\ P_{TRD}$								
TRD	158	157	157	139	96	107	108	44
FPC	47	40	34	52	36	24	21	70
Either	5	5	6	2	17	17	14	30
Not sure	1	2	3	2	2	0	3	6
Blank	0	0	0	0	0	0	0	1
K. $P_{RDF} = 0.5\ P_{TRD}$								
TRD	116	111	126	103	77	89	89	32
FPC	83	81	67	83	47	37	32	77
Either	8	7	3	5	21	17	18	33
Not sure	4	5	4	4	6	5	7	8
Blank	0	0	0	0	0	0	0	1

TRD: Traditional (preparation); FPC: Fish Protein Concentrate; P: Price

Table E.3 Tabulation of Selected Test Results of the Direct Comparison Between Roller-Dried Fish and Fish Protein Concentrate in the Form of Frequency Distributions.

Preference	Kasetsart University		Jute Mill	
	Kaeng som	*Nam prik*	*Kaeng som*	*Nam prik*
Sample size	199	198	150	149
A. Colour of RDF				
Very much	33	50	32	55
Much	84	103	62	62
Fair	72	44	49	31
Not much	10	1	6	1
Not at all	-	-	1	-
Blank	-	-	-	-
B. Colour of FPC				
Very much	27	21	27	11
Much	71	69	47	59
Fair	91	88	65	64
Not much	10	15	9	14
Not at all	-	5	2	1
Blank	-	-	-	-
C. Consistency of RDF				
Very much	33	42	32	50
Much	73	98	69	63
Fair	83	58	43	33
Not much	10	-	5	3
Not at all	-	-	1	-
Blank	-	-	-	-
D. Consistency of FPC				
Very much	29	26	32	20
Much	60	79	58	62
Fair	102	77	55	59
Not much	8	12	4	8
Not at all	-	3	1	-
Blank	-	1	-	-
E. Teste of RDF				
Very much	30	43	23	45
Much	72	86	64	63
Fair	83	60	54	36
Not much	13	9	8	4
Not at all	1	-	1	1
Blank	-	-	-	-

Table E.3 (continued)

Preference	Kasetsart University		Jute Mill	
	Kaeng som	*Nam prik*	*Kaeng som*	*Nam prik*
F. Taste of FPC				
Very much	28	17	27	12
Much	56	65	46	58
Fair	97	89	64	64
Not much	16	23	11	13
Not at all	2	4	2	2
Blank	-	1	-	-
G. Smell of RDF				
Very much	25	34	25	42
Much	68	101	61	63
Fair	90	60	58	41
Not much	16	3	4	3
Not at all	-	-	2	-
Blank	-	-	-	-
H. Smell of FPC				
Very much	31	5	26	4
Much	50	75	49	56
Fair	96	82	67	65
Not much	20	22	7	12
Not at all	2	4	1	2
Blank	-	-	-	-
I. Price FPC = Price RDF				
RDF	93	128	51	81
FPC	70	36	37	17
Either	28	27	57	47
Not sure	8	7	5	3
Blank	-	-	-	1
J. Price FPC = 0.75 Price RDF				
RDF	82	122	44	77
FPC	97	66	59	31
Either	10	5	41	37
Not sure	10	5	6	4
Blank	-	-	-	-
K. Price FPC = 0.5 Price RDF				
RDF	62	96	36	63
FPC	116	90	67	43
Either	10	5	39	38
Not sure	11	7	8	5
Blank	-	-	-	-

RDF : Roller-Dried Fish
FPC : Fish Protein Concentrate
P : Price



1. Traditional "Kaeng Som" (~~right~~ Top) and "Kaeng Som" cooked with Roller Dried Fish (~~left~~ bottom)



2. Traditional "Kaeng Luang" (~~right~~ left) and "Kaeng Luang" cooked with Roller Dried Fish (~~left~~ right)



3. Traditional "Naam Prik" (left) and "Naam Prik" cooked with Roller Dried Fish (right)



4. Traditional "Kaeng Liang" (~~left~~ right) and "Kaeng Liang" cooked with Roller Dried Fish (~~right~~ left)



5. Traditional "Kaeng Kua" (right) and "Kaeng Kua" cooked with Fish Protein Concentrate, type B (left)



6. Traditional "Naam Prik" (left) and "Naam Prik" cooked with Fish Protein Concentrate, type B (right)



7. Traditional "Kaeng Som" (~~left~~ top) and "Kaeng Som" cooked with Fish Protein Concentrate, type B (~~right~~ bottom)



8. Traditional "Kaeng Kare" (right) and "Kaeng Kare" cooked with Fish Protein Concentrate, type B (left)



9. Pretesting new preparations and questionnaires with 40 Jute-Mill workers



10. A close-up of pretesting at Jute-Mill



11. Serving traditional and new preparation for testing at Jute-Mill



12. Jute-Mill workers eating traditional "Kaeng Som" and "Kaeng Som" cooked with Roller Dried Fish and filling questionnaires



13. A close-up of testing at Jute-Mill



14. Kasetsart University workers comparing traditional "Naam Prik" and "Naam Prik" cooked with FPC and filling questionnaires



15. Packages of Roller Dried Fish and Fish Protein Concentrate, type B given during product assessments by the test participants



16. Giving a souvenir to a Jute-Mill officer for his co-operation and assistance to the project



17. Drawing prizes, one of the incentives used for obtaining regular and full participation



18. Testing the new preparations with school-children at the Kampanksan Campus of Kasetsart University